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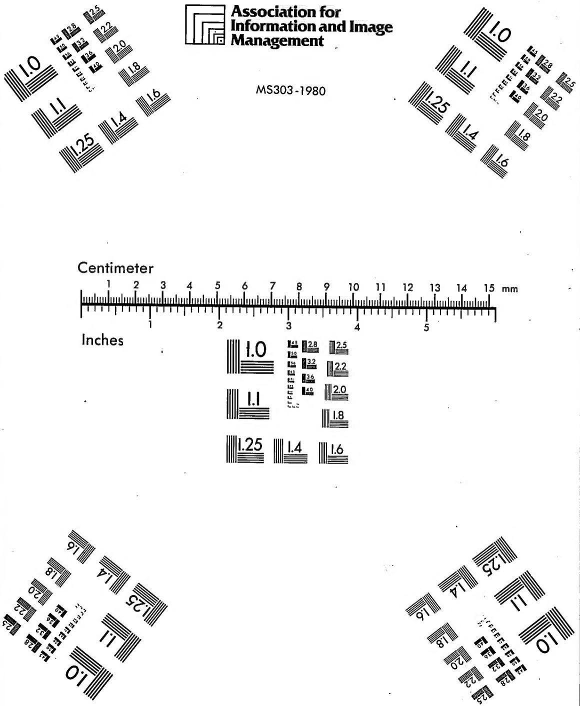

Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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A Note on the Sources

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 36

NOTEBOOK SERIES (NBK-14)

Menlo Park Notebooks, #95 - #113

Menlo Park Notebook #95 [N-80-00-03]

This notebook is undated but probably was used during 1880 and 1881. The entries appear to be by Charles L. Clarke. The book contains a record of technical and scientific books and their prices. It is subdivided into the following categories: electricity, steam engineering, treatises on general science, gas, general engineering, and mathematics. The first page is inscribed "Catalogue of Scientific Books." The book contains 284 numbered pages.

Blank pages not filmed: 10-33, 44-69, 78-117, 124-147, 156-175, 180-283.

No. 95

No. 95

1

Catalogue of Scientific Books

Electricity

Angell.
Elements of Magnetism and Electricity $0.75

Calland.
Essai ~~sur~~ les Piles.
$1.00

Clark,
An Elementary Treatise on Electrical Measurement for the Use of Telegraph Inspectors and Operators. $2.00

Ferguson - Electricity $1.75.

Napier - Manual of Electro-metallurgy.
$3.75

Guthrie.
Magnetism and Electricity.
$1.50

Radau,
~~Le Magnatisme.~~
104 Wood Cuts. $1.00

Bos,
La Physique
$3.60

Day, Exercises in Electrical and Magnetic Measurement. $1.25

Mascart.
Traité D'Electricité.
K $12.10

Tyndall.
Lessons in Electricity at Royal Institution
$1.25

Cumming.
Theory of Electricity.
OK 1879 $3.00

Bottomley. OK
Electrometers. $0.50

~~Dolbear,~~
~~The Telephone,~~ $0.75

Bell. The Telephone. $0.60

Niaudet.
Traité elementaire de la Pile Electrique. $2.40

Noad.
Text-Book of Electricity.
~~OK~~ $4.50

Higgs.
Electrical Transmission of Power. $1,20

Electric Lighting.
Report to House of Commons. 1879. K $2,00

Dub,
Der Elektromagnetismus $3,70
Die Anwendung des Elektro-Magnetismus mit besonderer Berücksichtigung der neueren Telegraphie. $7,70

Kohlrausch, F.
Leitfaden der praktischen Physik mit einem Anhange. Translation. CK $1,90

Steam Engineering.

1/10 at S.L.

Bourne

A Treatise on the Steam Engine.

VanN. London $15.00

Complete treatise, considered one of the best.

Nystrom. $3.50

Pocket-Book of Mechanics

Contains full practical tables for the mechanical engineer and steam user

---

Trowbridge

Tables and Diagrams relating to Non-Condensing Engines and Boilers $2.50

Very good.

Jellet.
A Treatise on the Theory of Friction. $4.00

Box.
A Practical Treatise on Heat as applied to the Useful Arts. $4.25
Very good and practical.

Stewart-Balfour.
An Elementary Treatise on Heat. $2.50

Porter. The Richards' Steam Indicator.

$3.50

The best book out.

Siemens,
Fuel 10.50

Gordon.
Elementary Book on Heat.
$0.75

Irving. Short Manual of Heat for schools.
$1.25

Spon.
The Present Practice of Sinking and Boring Wells, with Geological Considerations and Examples of Wells Executed,
$3.00

Iveson's Horse Power Diagram.
$4.25

Buell.
Safety Valves.
$0.50

McCulloch.
Mechanical Theory of Heat.
$3.50

Fell.
Notes on Using Steam Expansively.
$0.60

Nystrom.
A New Treatise on Steam Engineering, Physical Properties of Gases and of Different kinds of Vapor.
$2.50

Rowan.
On Boiler Incrustations.
$0.40

Stewart, Balfour.
Elementary Treatise on Heat.
$3.00

Rigg. A Practical Treatise on the Steam Engine.
$12.00

Burgh.
Pocket-Book on Compound Engines.
$3.75

Pochet.
Steam Injectors, their Theory and Use.
$0.50

Le Van.
Steam Boiler Engineering.

Bramwell.
The Steam Engine.
$0.20

Poillon,
Cours théorique et practique de chaudières et de machines a vapeur.
$8.00

Boilers.
Deterioration of.
Parlimentary Report.
$5,50

Graham.
Elementary Treatise on Steam.
$3.50

Cotterell,
Steam Engine as a Heat-Engine.
$5.00

Hirn

Fourier,
Analytical Theory of Heat, Translation, 1878.
$5.00

Baynes,
Lessons on Thermodynamics.
$2.75

~~Clark, D. K.~~
Fuel,
Its Combustion and Economy.
$1.50

Treatises
on
General Science.

Go

Ganot's Natural Philosophy

Deschanel's Natural Philosophy

Jamin - Physics.

Weinhold -
Experimentale Physics.
translated from the German $15.75

Noble - Useful Tables. $0.25.

Weale's
Engineers, Architects and Contractors' Tables. $3.00

Garnett, Elimentary Dynamics for Schools and Colleges. $3.00

Walker,
Prime Cost of Keeping, for Engineers, Iron Founders, Boiler and Bridge Makers &c.
$3.50

Seylor's.
Pocket-Book for Boiler Makers and Steam Users, $2.00

Unwin,
Tables of Logarithms, English and Metric Measures &c.
$0.80

Arnott: Elements of Physics.
$3.00

Everett, Illustrations of Centimetergamme.
$2.00

Todhunter,
Natural Philosophy for Beginners. Each $1.50

Everett. Elementary Physics.
$1.75

Lees,
Acoustics, ~~Light~~ and Heat.
$1.50

Pernolet,
L'Air Comprimé et ses applications. $8.00

Putnam.
Metric System of Weights and Measures. $1.00

Scribner's
Pocket-Books
Each $1.50.

Thomson & Tait.
Natural Philosophy.
$4.50

Chandler;
Petroleum as an Illuminator
$0.50

Giroud,
De la Pression du Gas d'Eclairage et des Moyens a employer pour la Regulariser. $3.60

Fodell,
~~A Practical Treatise on the Science and~~
A System for Keeping the Histories and Accounts of Gas Light Companies, with Forms &c usual for Such Companies $5.00

Matthews,

An Historical Sketch of Gas Lighting,

London 1827.

Accum,

Description of the Process of Manufacturing Coal Gas.

London 1818.

These books interesting to show gas lighting in its infancy.

Hughes,

Gas Works and Manufacturing Coal Gas.

$1.40

Richards,

A Practical Treatise on the Manufacture and Distribution of Gas.

Wilson,

Common Sense for Gas Users. $1.00

King's Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas.

Edited by T. Newbigging.

Vol. I now pub.

Recommended by <u>Engineering</u> as the best in English Language.

General

Engineering.

Reuleaux.

Kinematics of Machinery.

$7.50

Achard.

De la Transmission et de la Distribution des Forces Motrices a grand distance.

$3.00

Stahl. Transmission of Power by Wire Ropes.

$0.50

Clark. A Manual of Rules, Tables and Data for Mechanical Engineers.

$7.50

The best.

Howard.
Hydraulic Presses and other Hydraulic Machinery.
$1.25

Box.
On Mill Gearing, Wheels, Shafts, Riggers &c. $3.00

Haupt.
A Manual of Engineering Specifications and Contracts.
$3.00

Zahner.
Transmission of Power by Compressed Air.
$0.50

Thurston, Prof. R. H.
Friction and Lubrication. Determination of the Laws and Coefficients of Friction by New Methods and with New Apparatus. $1.50

Ledoux. M.
Ice Making Machines.
$0.50

Ingenieur's Taschenbuch
$2.65

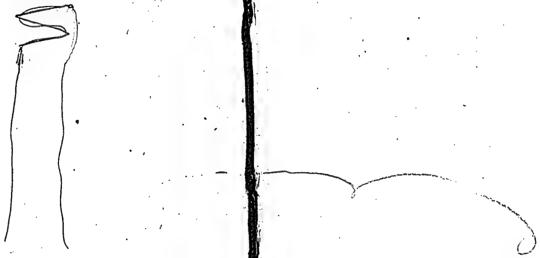
Weisbach.
Lehrbuch der Ingenieur- und Maschinen-Mechanik.
$20.00

Der Ingenieur
Very good. $2.10

Spon's Dictionary of Civil, Mechanical, Military, and Naval Engineering. With technical terms in French, German, Italian, and Spanish. $40.00.

Mathematics.

Chambers' Mathematical Tables.
Logarithms 1 to 108000.
$1.75



Menlo Park Notebook #96 [N-79-09-20]

This notebook covers the period September-December 1879, with a few entries possibly dating from 1880. All of the entries are by Samuel D. Mott. Included are drawings of lamps, generators, vacuum pumps, and other devices such as the phonograph and the telephone. There are occasionally notes accompanying the drawings, some of which were used as illustrations in the Scientific American. The label on the front cover is marked "Private" and "S. D. Mott." The first page is inscribed "Edison's Inventions Notes & c." Both the cover and the first page are stamped "Edison Pioneers 40 West 40th Street New York City." The book contains 284 numbered pages.

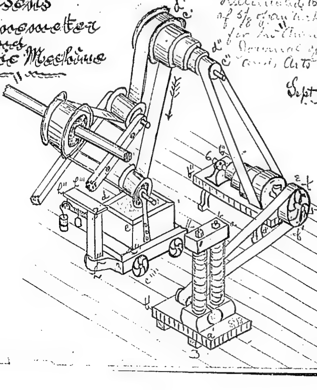
Blank pages not filmed: 53-284.

Missing page numbers: 9-10.

Edison's Inventions Notes &c.

a	b	7"
a'	b'	28½"
a"	b"	3' 1"
f"	f'''	20"
e	d	18½"
e'	d'	8"
e"	d"	4"
e	e'''	22"
ε	f	5"
f	f'	22"
g	h	4' 1"
h	h'	8"
g	h"	24"
h"	h'''	5"
a	3	5'
a	1	21½"
3	4	31"
5	6	3' 8"
c"	a'''	7"

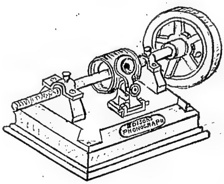
Edison's Dynamometer and Faradic Machine



Delineated to a scale of 5/8 of an inch to 3 feet for the "American Journal of Science and Arts".

Sept 20th 1879

Sept. 25th 1879.
S.D. Mott. Del.



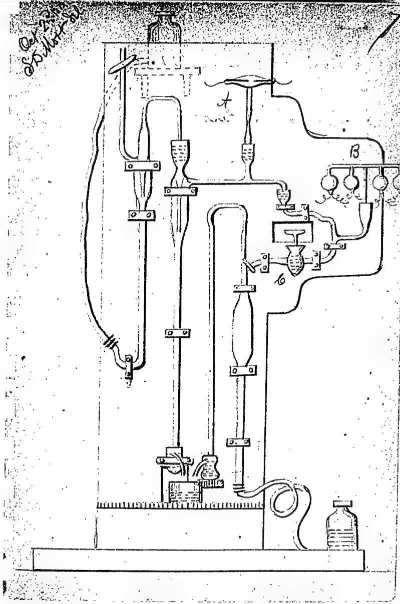
Edison's Pride.

9 Edison's combination of the Geissler and Sprengle fall tube pumps to obtain high vacua.

A - Electrical test of vacuum

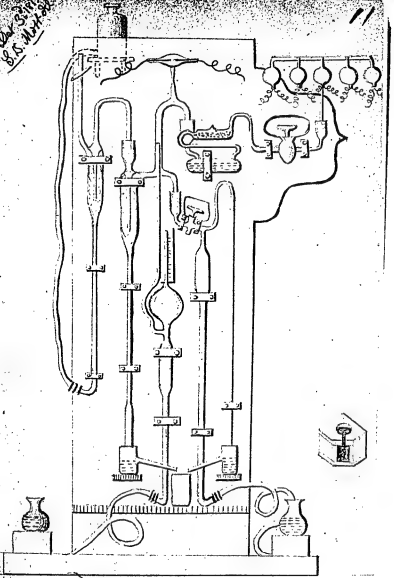
B - Electric lamps

C - Mercury seals



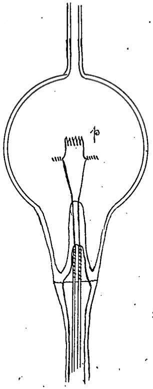
The same combination in connection with the Macleod gauge — And chambers of Sulphuric Acid (to take up moisture) and granulated Copper (to take up mercurial fumes)

Oct 3 1879
S.D. Mott



12

B



P - a platina spiral in vacuo —

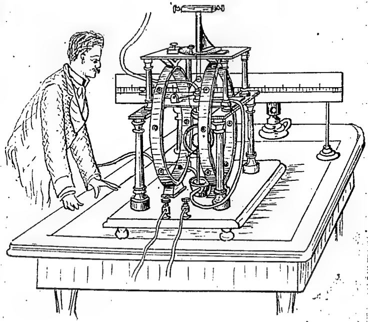
Edison's Lamp as it is at present

Oct - 1879. —

14

Illustrated in Scientific American of Oct 1879.

15

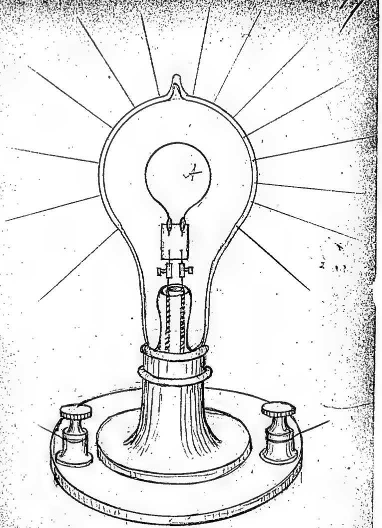


ELECTRO DYNAMOMETER.

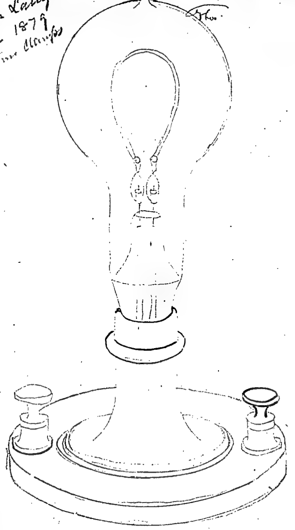
Lamp as it appears this date (Nov 1879)

A — loop of Clarks 3 - 3 cord thread rolled in [illegible] then [illegible] at a white heat [illegible] = 3 gas jets — [illegible] for 1 gas

[illegible] very good results also from [illegible] (bristol board)

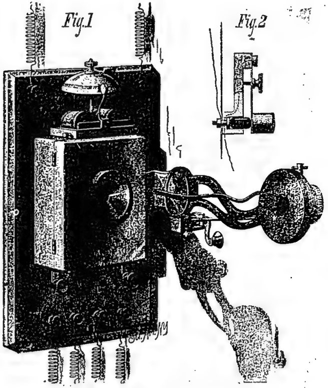


Paper Lamp
Dec 1879
Platinum clamps



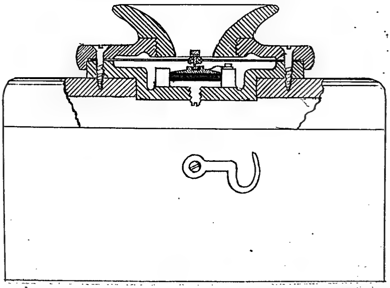
Illustrated in the Scientific American of Oct 1879.

23

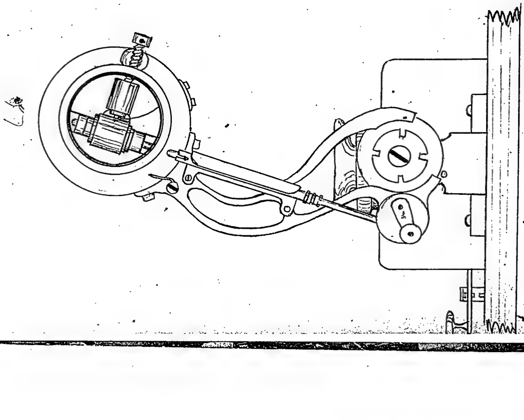


EDISON'S NEW TELEPHONE.

Delineated in Cross Section by myself for Mr Edison
Oct 15. 1879. Full Size tracing

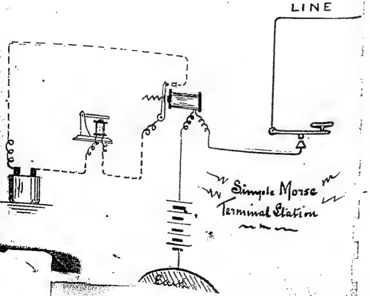


Delineated by myself for Mr Edison Oct 20th 1879.
One-half full size tracing.—

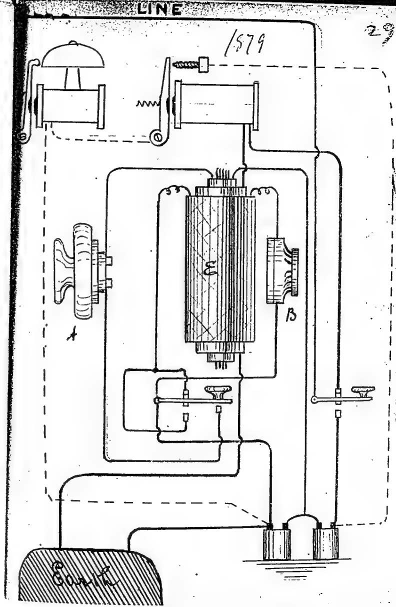


Deliniated to show the currents Connections & practical working of Edison's Telephone.

E induction coil
— Primary circuit
— Secondary "
— tertiary "
A Transmitter
B Receiver.
Relay Circuit in dotted lines



1879



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Primary circuit

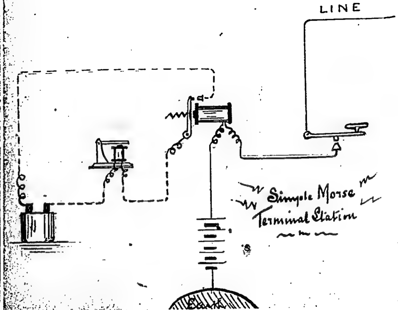
Secondary "

tertiary "

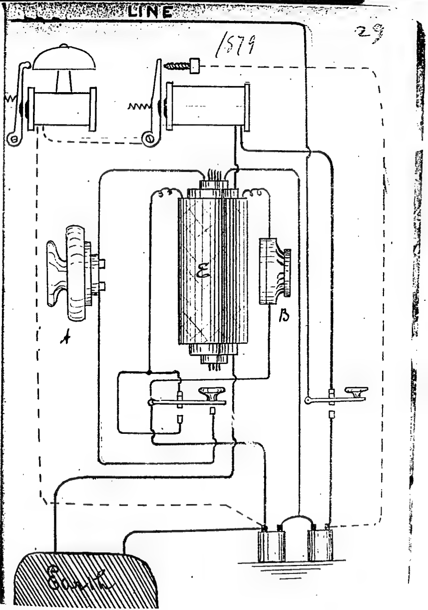
A Transmitter

B Receiver.

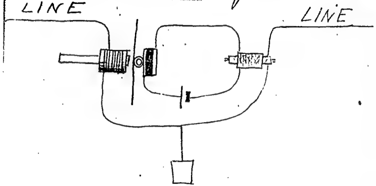
Relay Circuit in dotted lines



1879



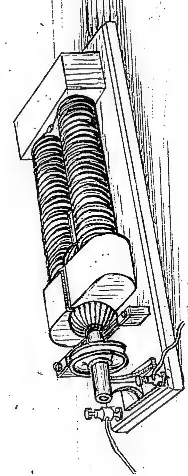
Telephone Relay



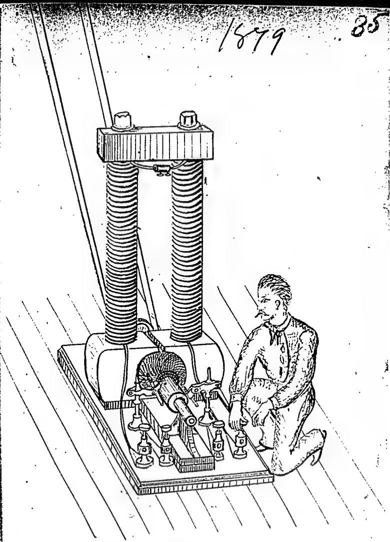
 Distribution of Energy in Electromotors —

Any receiving motor no matter what its resistance may be would if there were no friction run at the same speed as the transmitter, but as there is always friction it will run at a lower speed which speed will be such that it will set up a counter E.M.F. a little less than the transmitter the difference will exactly represent the work. If more work is attempted to be taken from the receiver there will be a lessening of the counter E.M.F., this lessening will represent the work — for instance, if we only have the friction of the machine the counter E.M.F. will be, say 98, 2 representing the work in friction. If we take off 3987 ft-lbs of work inclusive of friction with 10 ohms resistance in the circuit, the counter E.M.F. will be 90 volts to 100 volts in the transmitter.

We think that in any electromotor that the power will be within reasonable limits independent of the size of the magnets composing such motor with a given current — if the magnets are small in mass the speed will be great, if large in mass the speed will be slower, but the power will be greater & ballance the loss by want of speed, but with the large magnets is given more current and consequently have the advantage. The power obtainable is probably as the square of the size of the motor magnets — double the size and you can by increasing the current obtain 4 times the ft lbs with the same economy per 1000 ft-l. as in the smaller motor



Edison's Electric Motor.

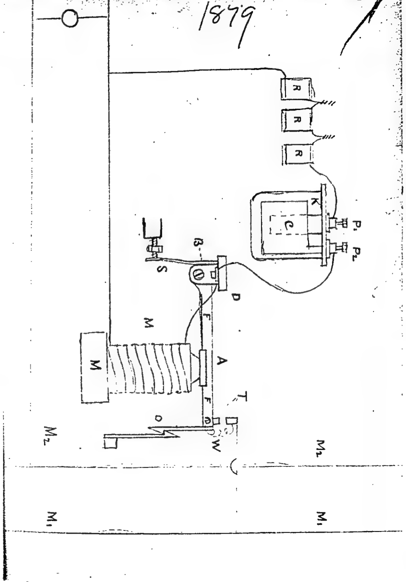


Edison's Electric Generator.

1879 37

The Meter
its action

Points T are supposed closed, Current enters from Main Line M through Binding post E_2 and passes through the points T by means of the bar F through through the hinge B to the binding nut D. — The Current at this point divides the larger portion of it passing around the Magnet M and directly out at the post E_1 and by means of the line H_1 to the lamp - the remaining portion at the point of division D passes through the Cell and Resistance Connecting to H_1 at E. All of it then passes through one or more Translating devices such as lamps motors &c to the line H_2 and the ~~Main~~ return main M_2. In passing around the Magnet M it tends ~~to make~~ render it ~~more~~ active so as to draw down the armature A, this tendency for the weak current is counteracted by the adjustable spring S — if the Current by any means is abnormally great it will make the magnet so strong as to attract the armature A ~~and~~ pull downwards the arm F, separating the points T and breaking the Circuit.

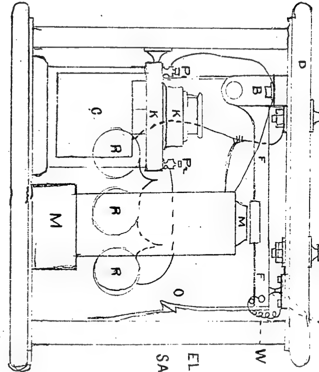


The Clutch O will then close as is represented [in] the diagram page 37 — The cover W serves to sh[ort] circuit the arc which would otherwise spring between the points T when the current has broken and also to prevent the armature with the break circuit from acting as a vibrator.

From the binding nut D a small portion of the current passes through the deposition cell K which is so constructed that every unit of current passing will deposit an amount of copper proportion[al] to the current flowing on the plate of copper.

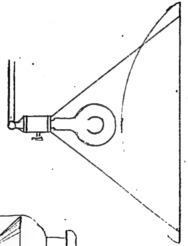
Resistances RRR are placed in the line so that the amount which flows through the deposition cell may be adjusted until a fixed fractional part of the main current is used. It is proposed to place a thin and exactly weighed plate into the meter at the commencement of a fixed period & at the end of that time [to] take it out & carry it to the central office where it will be [ex]actly weighed — the difference in weight is the amount deposited. A certain number of milligrams ~~of copper~~ may be assumed to equal to a foot of gas, by taking an Electric light of a given intensity say 16 candles and allow it to burn for a few hours noting the deposition of copper at the same time a gas flame of equal intensity is burned and the number of cubic feet consumed noted — the resistances will then be adjusted until 1 mg for example will represent 1 cu ft —

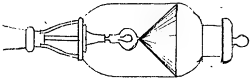
Bills will then for Electric light ~~will then~~ be made out in terms of 1000 cu ft — Parts $M M_2$ main lines in street — $H_1 H_2$ House lines of wire — L lamp[s] points at which the current may be broken. W ~~small~~ wire A armature O clutch M magnet B hinge S sp[ring] $P_1 P_2$ binding posts C copper plate R resistance coils D binder nut E E binding posts F Bar to which the armature A is atta[ched]

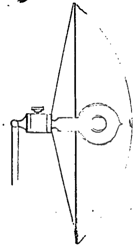


EDISON'S ELECTRIC METER AND SAFETY CLUTCH COMBINED.

In a paper read by Mr C.E. Jones of Chesterfield England before the association of Gas Managers, May 1879 — was said; "The chief requirements of public lights 1 steadiness of flame not susceptable of atmospheric commotions 2 uniformity of intensity 3. great penetrating power 4 Ever available without preparation and easily lighted 5 non liability of any sudden or self extinguishment 6 Shaddoless 7 Commercially Cheap"—







Laws relating to
Edison Electric lighting System

When the energy is doubled on a given radiating surface the light is quadrupled

With a given radiating surface, and a given energy, doubling the surface reduces the light 1/2 so that each of the two parts will have but 1/4 of the light that it originally had = Quadrupling the surface requires double the energy to produce the same light.

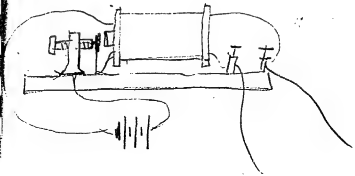
The resistance of any lamp in multiple arc is the square of the total resistance of all the lamps in series, the radiating surface being the same.

If any machine will keep 5 lamps of a given radiating surface and 1 ohm each resistance at 15 candle power when arranged in series then the same machine will keep 5 lamps of the same radiating surface of 25 ohms each in multiple arc at 15 candle power

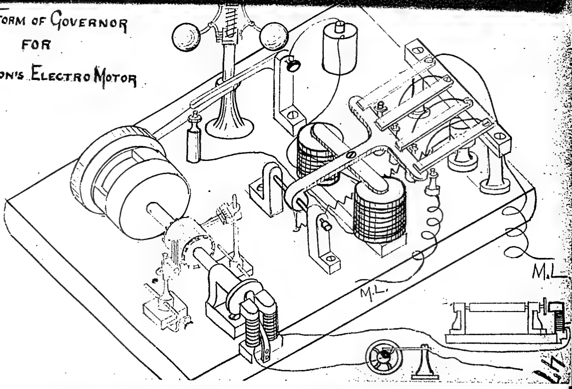
The cost of conductors and machine resistances are the same for 10 one ohm lamps in series as 10 - 100 ohm lamps in multiple arc = the resistance of multiple arc lamps must be 100 times greater than those in series to produce same results providing 10 are in one circuit.

44

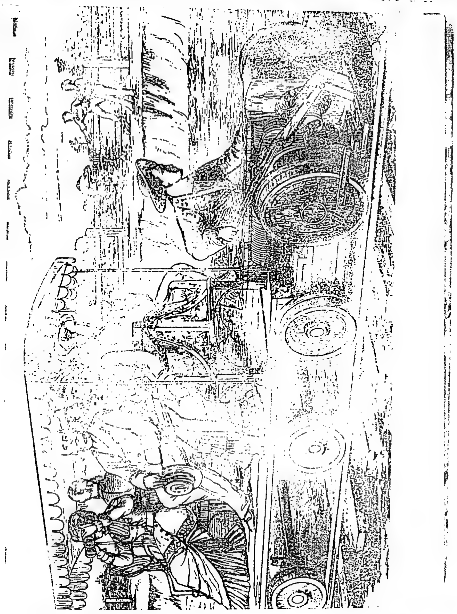
45



One Form of Governor
for
Edison's Electro Motor



48



The chief improvements that have taken place for the last few years, in Dynamo electric machines are based upon — 1st The principle of accumulation. 2d Continuous magnetization — In the [illegible] machine the principle of accumulation is employed — this machine with a Siemens armature $3\frac{1}{2}$ in diameter and 18 in effective length will deposit 28 oz of silver per hour when driven at a speed of about 2000 rev per minute by means of a 2 H.P. steam engine

Fig 1 = permanent magnets

Fig 2 = Electro magnets

The general principle of all dynamo Electric machines — The rotation within the influence of the poles of a magnet, of a Soft-iron armature surrounded by one or more helices, an electrical current being produced in the helices by the rapid magnetization & demagnetization of the Soft iron armature —

Menlo Park Notebook #100 [N-81-04-12]

This notebook covers the period April-July 1880. It is a continuation of Menlo Park Notebook #25. All of the entries are by John W. Lawson and consist of notes and tables relating to meter experiments. A set of calculations relating to these experiments was also found in the book. These loose sheets have not been filmed. The label on the front cover is marked "Meter Experiments." There are 284 numbered pages. Pages 20-39 contain skeleton tables that were never filled in. They have not been filmed.

Blank pages not filmed: 1-3, 54-284.

No.	[illegible]	Weight	Difference	Date	Time
1	456	15·5875	·161	April 12	4·50 P.M.
2	"	14·0000	·1616	"	"
3	"	18·9915	·1546	"	
4	"	14·4032	·1454	"	
5	"	8·0646	·0991	"	
6	"	7·9075	·1028	"	
7	"	8·338	·107	"	
8	"	4·1812	·0711	"	
9	"	4·1496	·0699	"	
10	"	4·0505	·0673	"	
11	"	4·0876	·0647	"	
12	"	8·4419	·1076	"	
13	"	8·474	·1055	"	
14	"	9·5969	·1108	"	
15	"	9·7677	·1078	"	
16	"	4·9265	·0550	"	
17	"	4·5265	·0545	"	
18	"	4·470	·046	"	
19	"	5·1243	·0529	"	6·20 "
20	00	11·428		13	12. M.
21	"	15·0042			
22	"	15·7535			
23	"	11·8112			
24	"	6·5432			

1 to 19 removed from solution. 16, 17, 18 & 19 thoroughly oxidized. The others all clean.

20 — 27, New plates washed in HNO_3 and placed in the solutions to remain there until signs of oxidation appear.

20 — 23 electrolytic copper.

24 — 27 hard rolled copper

The solutions had been acting on plates previously & this putting in of these

For solutions 20 — 23 see Bk. 25 pg 264

" " 24 — 27 pg 270

28, in 250 c.c. $Cu(NH_3)_2(SO_4)_2$ Sp. gr. 1.15 at 75° F.

~~To each solution was added 2 c.c. H_2SO_4~~

No. 6	Number of solution	Weight	Difference	Date	Time
25	00	6.5292		April 13	12.25 P.M.
26	"	6.5096		"	"
27	"	6.4414		"	12.35 "
28	"	9.8182		"	6. P.M.
29	"	10.3449		"	" "
20	336	11.3302	.0978	27	12. M.
21	"	14.908	.0962	"	" "
22	"	15.656	.0975	"	" "
23	"	17.7137	.0975	"	" "
30	00	32.6205		30	2. P.M.
31	"	28.215		"	
32	"	26.888		"	
33	"	22.4643		"	
34	"	23.6502		"	
35	"	23.6375		"	
36	"	25.029		"	
37	"	19.6205		"	
38	"	15.6108		"	
39	"	16.6565		"	
40	"	13.0065		"	
41	"	12.020		"	
42	"	8.925		"	3 "

Signs of oxidation
20-23 see pp. 4 and 5 –
also Pl. 25 – pp. 264, 266, 268,
270, and 272

29 in 250 c.c. $CuSO_4$ sp. gr. 1.217
at 75° F. To each solution was
added 2 c.c. H_2SO_4 conc. The
plates to remain in solution
until signs of oxidation ~~begin~~
appear.

Plates 20-23 – Length of time
534 hours taken to saturate
the 250 c.c. solution having
a copper surface of 8 sq. in.
presented to it. Whole average
amt. of Cu taken up by the
solution .1727 grm.

Plates 30-45 in solution
15 pts. solution $CuSO_4$ sp. gr.
1.13 at 75° F
1 pt. H_2SO_4 conc.
Surface of plates exposed to
action of solution
No 30 = 16 sq. in.
" 45 = 1 " "
each in the series varying from the other
by one square inch.

No.	hours in solution	Weight	Difference	Date	Time
43	∞	6.330		April 30	3.05 P.m.
44	"	4.600		"	
45	"	2.782	"	"	3.15 P.m.
25	668	6.353	.1762	May 11	8: A.M.
24	741	6.3727	.1705	14	9 "
26	"	6.3798	.1898	"	" "
27	"	6.2583	.1831	"	" "
30	431	32.369	.2515	18	3. P.m.
31	"	27.9815	.2335	"	
32	"	26.668	.220	"	
33	"	22.2565	.2078	"	
34	"	23.4313	.2189	"	
35	"	25.4328	.2047	"	
36	"	24.827	.202	"	
37	"	19.4405	.180	"	
38	"	15.4265	.1843	"	
39	"	16.497	.1595	"	
40	"	12.858	.1485	"	
41	"	11.8835	.1365	"	
42	"	8.798	.127	"	
43	"	6.221	.109	"	
44	"	4.511	.089	"	
45	"	2.7125	.0695	"	4.15 P.m.

24-27 see pgs. 4, 5, 6, 8 and 9 also Bk 25- pg 270 and 272

Plates 24-27, oxidized
amt. of Cu taken up by solution
from 24 = .196 grm. 26 = .209 grm.
25 = .196 27 = .202

Plates 30-45.

These results not to be relied upon for the reason that the areas upon the plates at the point of contact between the solution and air had been attacked to a greater extent than the other portions of the plates

30-45 see pgs 6, 7 and 8

No.	hours in solution	Weight	Difference	Date	Time
56	00	31.538		May 20	10.30 A.M.
57	"	27.119		"	
58	"	25.774		"	
59	"	21.406		"	
60	"	22.553		"	
61	"	23.634		"	
62	"	24.036		"	
63	"	18.543		"	
64	"	14.821		"	
65	"	16.103		"	
66	"	11.862		"	
67	"	11.518		"	
68	"	8.312		"	
69	"	3.927		"	
70	"	4.126		"	
71	"	1.748		"	11.45 A.M.
56	264	31.407	.131	June	
57	"	27.003	.116	1	10.30 A.M.
58	"	25.662	.112	"	
59	"	21.300	.106	"	
60	"	22.439	.114	"	
61	"	23.470	.164	"	
62	"	23.884	.152	"	

Plates 56–71 Same plates that were used in experiments 30–45. The arms were cut off so that there was no portion of the plates that was not covered with the solution, new solution same as in experiments 30–45—

Plates 56–71.

The discrepancies shown here in the losses from the plates is probably due to the vesicular structure of the copper, some plates exposing a proportionately greater surface to the action of the

No.	Strength solution	Weight	Difference	Volts	Time	
63	2.64	18.456	.087	1.		66-76 see page 10 and 11
64	"	14.684	.137	"		
65	"	15.971	.132	"		
66	"	11.800	.062	"		
67	"	11.467	.051	"		
68	"	8.275	.037	"		
69	"	5.886	.041	"		
70	"	4.102	.023	"		
71	"	1.728	.020			
72	oo	37.575		"	11.45 AM.	
73	"	10.773		4	1. P.M.	
74	"	34.5455		"		
75	"	21.8808		"		
76	"	21.091		"		
77	"	10.8105		"	1.25 "	
78	"	35.649		"	8.30 "	
"	"	18.167		"	" "	
79	"	125.940		"		
80	"	125.390		6	2. "	
81	"	22.6937		"	" "	
82	"	~~22.4588~~		7	8. AM.	
				"	" "	

solution than others _

Plates 72 – 77
Standard solution used
1 H_2SO_4 & 15 Cu SO_4 sol.
surface of plates exposed
to action of solution –

72 = 12 sq. in.
73 = 3 " "
74 = 12 " "
75 = 6 " "
76 = 6 " "
77 = 3 " "

72 and 73 in 500 c.c. solution
74 and 75 in 250 c.c. "
76 and 77 " 175 c.c. "

electrolytic copper, free from vesicularity used –

plates 78 –
2 plates in 500 c.c. sol.
both in one bottle
sq. surface of one = 12
" " " other = 6

Plates 79 and 80 made of wire

No.	hours in solution	Weight	Difference	Date	Time
72	81	37.4605	.0445	June 7	10. Rm.
73	"	10.7365	.0367	"	
74	"	34.4975	.048	"	
75	"	21.853	.0278	"	
76	"	21.0642	.0268	"	
77	"	10.7892	.0213	"	10.25
72	00	37.4652		"	11. Rm.
73	"	10.7433		"	
74	"	34.501		"	
75	"	21.8585		"	
76	"	21.0682		"	
77	"	10.7892		"	11.25 "
78	73.5	35.6055	.0435	"	10. Rm.
78	"	18.1455	.0215	"	" "
83	00	39.460		11	3 Rm.
83	"	11.235		"	
84	"	39.3275		"	
84	"	11.322		"	
85	"	38.422		"	
85	"	11.1505		"	
86	"	39.658		"	
86	"	10.865		"	

72–77 see figs 12 and 13

78 see figs. 12 and 13

.13 in. dia. The wire was made into a coil and placed 450 c.c. standard solution each coil exposing a surface of 8 sq in.

Plates 81 and 82 made from electrolytic copper each placed in 450 cc. standard solution and exposing a surface of 8 sq. in. each.

Plates 83–92.

Standard solution used 10 vessels used, 2 plates in a vessel each vessel containing 525 c.c. sol.

~~No of~~ Sq. in. of plates in the vessels. –

Vessel	sq. in. of plates
83	16 and 4
84	16 and 4

No	hours in solution	Weight	Difference	Date	Time
87	00	42·245		June 11	
"	"	32·754		"	
88	"	41·741		"	
"	"	24·399		"	
89	"	41·5545		"	
"	"	18·088		"	
90	"	31·335		"	
"	"	17·4365		"	
91	"	31·2135		"	
"	"	7·6595		"	
92	"	30·725		"	
"	"	25·465		"	
83	475	39·245	·215	July 1	10 AM.
"	"	11·160	·075	"	
84	"	39·071	·2565	"	
"	"	11·241	·081	"	
85	"	38·188	·234	"	
"	"	11·075	·0755	"	
86	"	39·438	·220	"	
"	"	10·791	·074	"	
87	"	42·033	·212	"	
"	"	32·5945	·1595	"	

Vessel	sq. in of plate
85	16 and 4
86	" " "
87	16 and 12
88	16 and 8
89	16 and 6
90	12 and 6
91	12 and 2
92	12 and 8

No	hours in solution	Weight	Difference	Date	Time
88	475	41.5215	.2195	July 11	
"	"	24.284	.115	"	
89	"	41.315	.2395	"	
"	"	17.960	.128	"	
90	"	31.108	.227	"	
"	"	17.310	.1265	"	
91	"	30.9655	.248	"	
"	"	7.597	.0625	"	
92	"	30.512	.213	"	
"	"	25.315	.150	"	
79	610	125.401	.539	2	10 A.M.
80	"	124.858	.532	"	"
81	592	22.418	.2757	"	"
82	"	22.147	.3118	"	"
28	1944	Perfectly clean to-day		3	
29	"			"	

83-92 see pg. 14, 15 and 16

79-82 see pg. 12, 13 and 15

28-29 see pg. 5, 6 and 7

Refer to Bk. 25.

Plates 1 to 6, to note the action of solution ~~of~~ on copper -

see pages 238, 240, 242, 244, 246, 248, 250, 252 -

4 and 5 stop on page 244

6 stops on " 242

5 and 6 not on page 240

plates 7 to 15, to ascertain if the action of solution on copper is influenced by form of plate

see pages 240, 242, 244, 246, 248, 250, 252 -

10 to 15 not on page 244.

7 & 9 remarks on page 241 -

plates a to h, to ascertain the relation between surface quantity of solution and loss, and to obtain data for constant loss -

see pages 242, 244, 246, 248, 250, 252 –
9 stops on page 250 –

A new series of experiments commence ~~of~~ on page 254 –

Plates 1 to 24, to ascertain difference of loss from equal surfaces in unequal quantities of solution, unequal surfaces in equal quantities of solution and also to note how the loss is influenced by the structure of the copper –

plates 1 to 18, see pages 254 and 260, 262,
19 to 24, see pages 254, 256, 258, 260 –

Page 262 commences a new series of experiments

Plates 1 to 23, to ascertain relation between surface, quantity of solution and loss; these bring in some notes on temperature see page 264
1 to 19, see pages 262 and 264
20 to 23 " " 262, 264, 266, 268, 270, 272 and in Bk 100, pages 4, 5 and 6

plates 1a to 3a see page 270

plates 24 to 27, to observe the influence of the structure of copper on ~~the action~~ see pages 270, 272, and 273 also in Bk. 100, pages 4, 5, 6 and 8 —

P Book 100

Plates 28 to 29, to ascertain whether free acid in the solution would not increase and extend the action through a longer period
see pages 5, 6, 7 and 18

---

plates 30 to 45, relation between surface and loss
see pages 6, 7 and 8

---

plates 56 to 71 The same
see pages 10, 11 and 12 -

---

plates 72 to 77 The same
see pages 12, 13 and 14 -

---

plates 78 The same - both plates this time under as nearly ~~the~~ same conditions as possible
see pages 12, 13 and 14 -

plates 79 to 82, to ascertain whether action of solution would be the same on equal surfaces in equal quantities of solution, whether such surfaces are plane or curved

see pages 12, 13, 15 and 18

plates 83 to 92, relation between surface and loss.

see pages 14, 15, 16, 17 and 18

The loss is proportional to the surface
see 83 to 92
Bk. 100, pgs 14, 15, 16, 17 and 18

is continually decreasing, represented by a curved line see 1 to 15
Bk. 25, pgs. 238 to 252

is affected greatly by differences in temperature
see Bk 25, pg 266 to 272
also on sheet 2 No. 8

Best solution to use is one containing free acid as then ~~the~~ action extends through a much longer time

see 28 and 29
Bk. 100, pgs 5, 6, 7 and 18

solution in use
15 pts solution in H_2O $CuSO_4$
sp. gr. 1.13 – 75° F.
1 pt. H_2SO_4 conc.

A less amount of H_2SO_4 might be used

Menlo Park Notebook #102 [N-80-06-28]

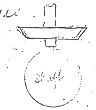
This notebook covers the period June-September 1880. The entries are by Charles Batchelor and relate primarily to the electric lamp. Included are notes and drawings of a clamp-making machine; notes and drawings of cutters, shapers, and testers for bamboo fiber; notes and drawings of instruments for attaching carbons and for bending and tapping wires for clamps; and notes and calculations about a new mercury pump designed on the screw principle. There are also notes on the lifting power of palmetto fans, relating to electric balloon experiments; notes on a pump, apparently for water; and notes and drawings of an electric rock drill. The label on the front cover is marked "Batchelor" and "June 28 80." The book contains 284 numbered pages.

Blank pages not filmed: 100-221, 224-279.

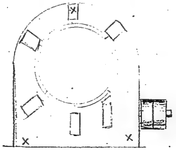
Missing page numbers: 87-90.

Notes on New Lamp Making Machine June 28th 1880

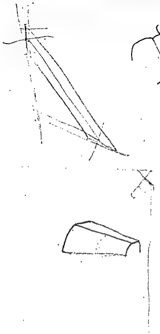
1= Alter position of Cam shaft so ~~that~~ the feeding device shall be driven direct by bevelgear



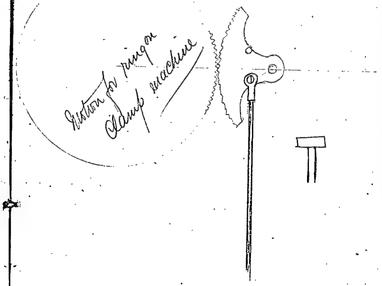
2 Make shape of top part so:-



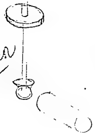
Standing on 3 legs at XXX

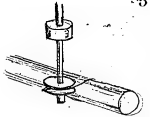


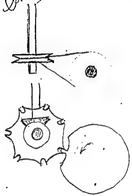
		10·616
2 = 2" cones 12" Long. =		10·616
1. Keeper $2\frac{1}{8}$ X $2\frac{1}{8}$ – 12 in		15·2
Head ~~8~~ X 3 X 3		25 00
	lbs.	56

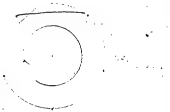


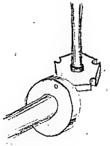
Clamp machine
July 3rd 1880
Chas Batchelor



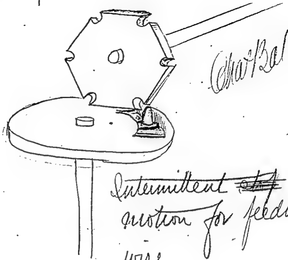








Clamp machine July 3rd 1880



Chas Batchelor

~~Intermittent stuff~~ motion for feeding wire

60
4
240
2400
2400

Centres 4" apart a

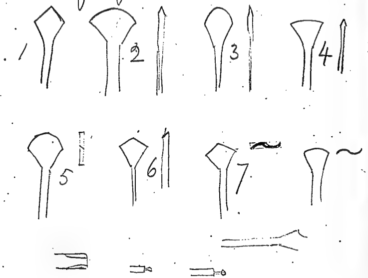
1 — 4

large 1

small 4

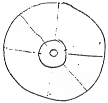
What is D of large and small

Drills for platina



31·4
10

31·40



2·7

2-10¾ — ~~2~~8½

2-7¼ 1·10

14½

8½

2' 1'

1 14½

4 Vanes as much

2 · 9½   2 9
1 · 13   1 11½

2 · 8½   8½
1 · 10   6

1 6½   7½
         9

2 · 8½
1 5

1 · 3½

11.75
11.75
5875
8225
1175
1175
1307.3125

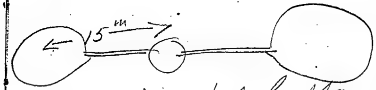
144 1301
36
108
108
216

216/18

216 : 18

144
216/2592 |12
216
432
432

200 revolutions



2 ordinary palmleaf fans
gave lifting power of
12 ounces to square foot

Yellow Jacket

1 Comp. 30" x 12 feet H.P. lift
cond. 60" x 12 " 500 200 tons per stroke

double line of No 14 pumps lift about
250 feet 10 ft stroke capacity
of stroke 80 gallons 6 to minute
or 480 galls per minute
for each line of pumps

Then what we want is
to raise 960 galls per minute
What height?

960 galls
8 lbs
7680
250
384000
15360
1.920.000

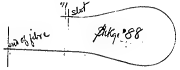
33000
1920.000
640
58 H.P.

7680
960 921.600
460

Bamboo fibres . July 15th 1880

~~J.B.H.P.~~

slot to end Length 4.40 per cent Shkge 20/



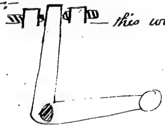
4.40
.44
.88 – To make mould to –

Clamp Machine July ~~13~~ 20 1880

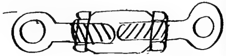
Improvement on model —

1 ~~Shaft bearings~~ made with caps so as to take shaft out

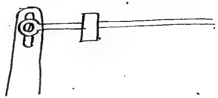
2 Lever for shears to be adjusted so:—



3 Link for punch to be adjusted:—

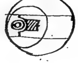


4 Connection between Cam lever and 'ring rod' to be positive so:-



5 Shears must be made to stand up an eighth and their points let down so:-

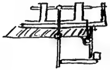
6 Top of button must be larger but position same and

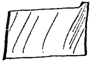


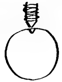
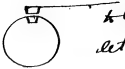
top excentric so as to give more length to the clamp holder.

7 Clampholder must be stronger with more bearing and act as a drill jig

8 In first drilling machine an extra slide must come up and hold jig against the round surface whilst the drill enters



9 Monitor ring must be an eighth thicker and the inside edge so:  to keep oil and dirt from joint

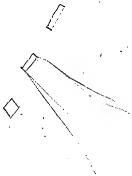
10  Instead of button spring like this make one so:- also put a pin  to lift spring out and let go when button has begun to turn.

11 Make all the cams with outside and ~~inside~~ flange

12 Make clutch at least $3\frac{1}{2}$ diameter so as to easily spring back

Distance bw centre main S. Shaft $4\frac{21}{32}$

N N N



~~Plug 10" Inside 7"~~

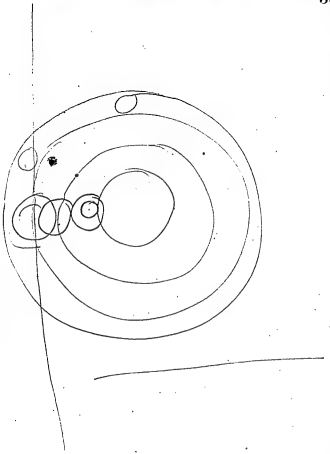
13. Make lock pin lift out with a fork ——

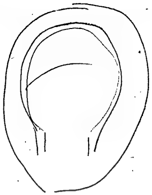
14 Distance from centre of work to centre Cam Shaft

16ths

3 - 6
1 - 5
 - 11
 13
6 - 3/16

3 - 6
1 - 5
 11
5 - 6

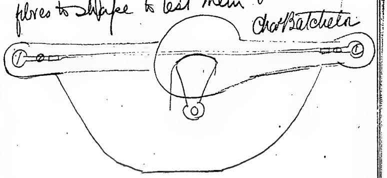


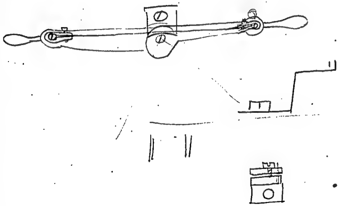


Instrument for bending fibres to shape to test them

July 21 1883

Chas Batchelor

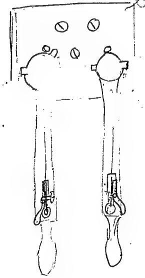


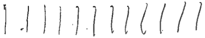


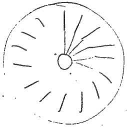
Fibre tester

July 25
1880

Chas Batchelor



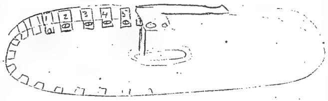


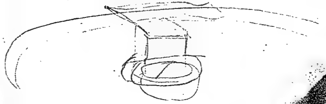


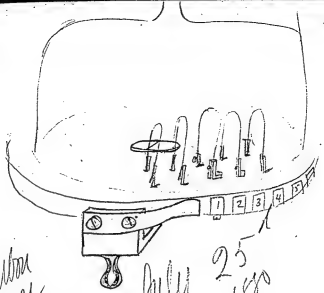
Canton River

July 25
1880

Chas Batchelor







Carbon paper

July 25 1880

C Batchelor

25.000 pe mile
300
7.500.000

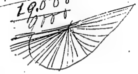
30.000 10 miles
30
900.000

60 H.P.
3
4 lb coal 240 lb
24
960
480
5760

8
2 tons $5 ~~8~~ 9
3 tons Dust coal ~~4~~
2 men 3
4 boys 50
Oil – Waste
$ 1050

120 100 ft
10 ~~000~~
1,200,000

2 32 300000
4/150000
19,000
~~000~~



100

1200 1000
1200 grs. in 1 ton
100000
24/120,000,000
30,000,000
5000000
17/250000
21,000

365/20000 35
1825
1750

Characteristics of a rock drill
Appleton 675

— Variable length of stroke —

— Must have rotary motion —

— External gear if possible to be avoided

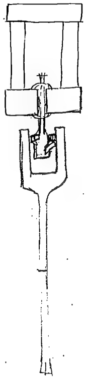
— If stroke is too short it will clog instead of churning up the débris

— Hard rock 3½ in stroke

— Soft rock 6 or 7 inches

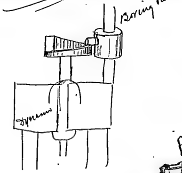
— Necessity of wide variation of stroke
Appleton 675 p.

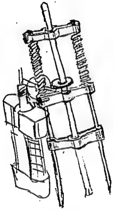
— Necessity of striking a light or a heavy blow

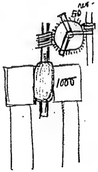


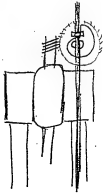
Electric Rock Drill

July 25th 1880
Chas Batchelor



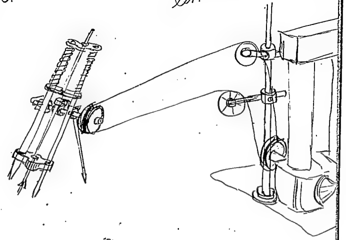


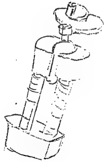




Electric
Rock drill

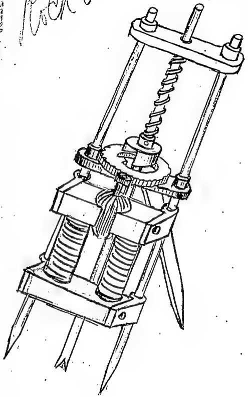
July 25 1880
Chas Batchelor





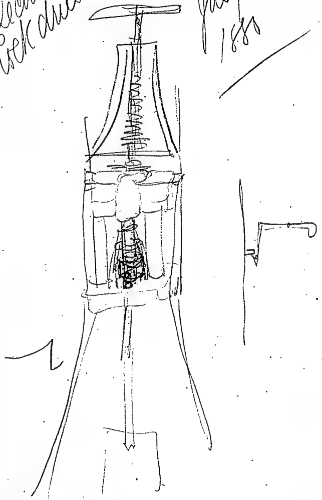
Electric
Rock drill

July 25th
1880
Chas Batchelor



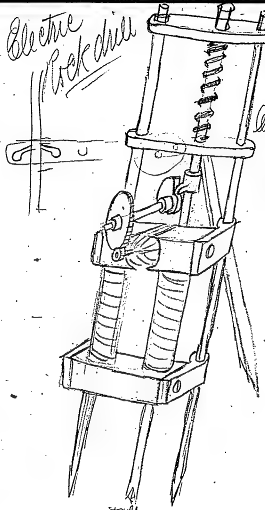
Electric Rock drill

July 25 1880



Electric Rock drill

July 25 1880



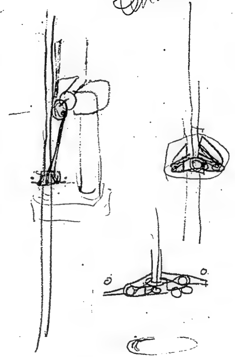
Chas Batchelor
or
how about ~~shaft~~ Cam
direct on
shaft

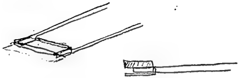
Electric
Rockdrill

lift motion

July 25
1880

Chas Batchelor





Lamps Aug 3 1880

Have John Ott make some
Nickel Clamps

Use Iron screws with all our
experimental lamps at ~~presen~~

Rock drill

Engineering Vol 14 Page 55 —
McKean rock drill

adapted for 500 to 1000 strokes per minute — stroke of piston and fall of cutter $2\frac{1}{2}$ to 3" —

8.26

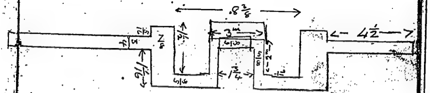
146

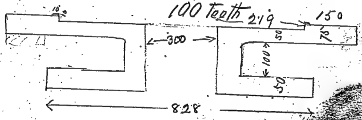
43

Clamp machine bed

Aug 4 1880

Chas Batchelor





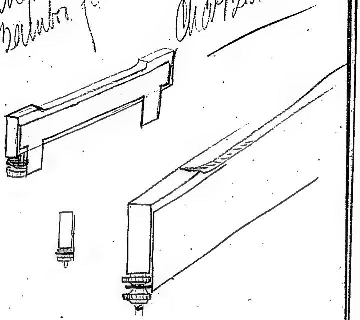
Pitch line 8.18 diam
Whole diameter 8.28

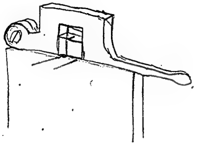
$$\begin{array}{r} 150 \\ 219 \\ 300 \\ 219 \\ 150 \\ \hline 1038 \end{array}$$

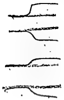
Cutting moves for Bamboo fibres

Aug 20

Chas Batchelor

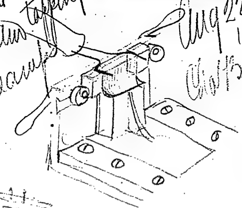


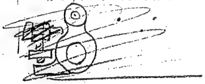


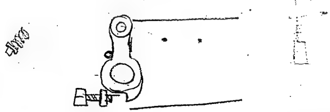


Instrument for boring and tapping hole for clamps

Aug 22nd 1880
Chas Batchelor





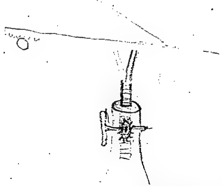


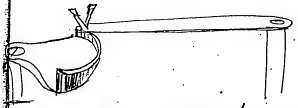
$$\frac{2}{P} = \frac{2}{22} = 22\,\Big|\,\begin{array}{l}200\\198\end{array}\Big|\,0.09$$

$$.09 + f =$$

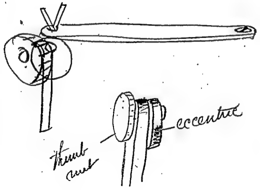
$$D' = 8.18$$

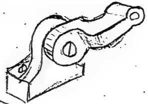
$$D = \frac{N+2}{P} = \frac{180+2}{22} = \frac{182}{22}\,\Big|\,\begin{array}{l}182\\176\\1.60\\\;\;44\\1\;60\end{array}\Big|\,8.28$$

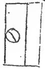


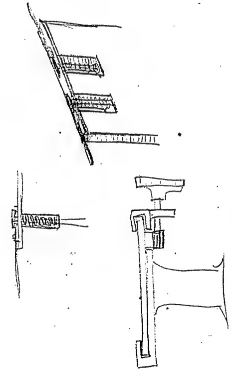


Adjustable support for inside parts



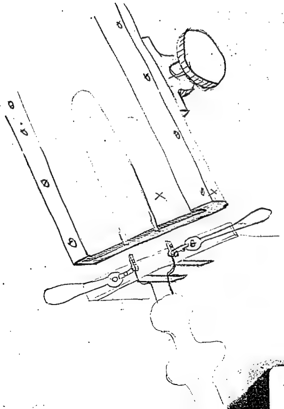


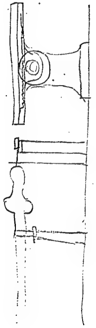




Aug 22nd 1880
Chas Batchelor

Inst for
putting on Carbons





$12^{1/2}$

.017
.0031
.0527

Make

~~3.1 2.42~~

.017 × .0031 × 2.42 makes a lamp.

of

17 × 8 × 3 ~~000~~ .0056 .000 = 100 R
R.S. 50 - 136

17 × 2 × .038
R.S. .038

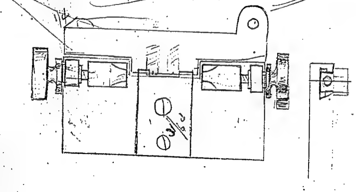
17 × 3 × 37.
R.S. - 40

.017 × .001
R.S. 36

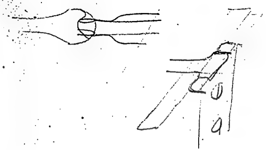
17 × 3 . ~~3.6~~ / 3.5

40 - 51.
6.6 8.5
3.3 4.25
49.9 63.75

Machine for bending wires and putting in Clamps Feb 1st 1880



Base 12 X 4 X $\frac{1}{2}$



New Mercury pump on Screw principle

1½   14 in

14 ÷ 11

11
25 × 14² =
196
150
225
25

2.46) 49000.0000 (2000
4 9 3 4 8

1½
11
12½ × 1½²
2.25
625
450
150
17.125
2.46

20000 27²
784
5424
43.1152
21½

1.5
1.5
75
15
2.25

12·6
2·25
630
252
252
28350
2·47
198450
113400
56700
70·02450

1·5
1·5
75
15
2·25

35
17½

35
50
1200

Pump.

1/2 inside diameter

Centre to centre 12·5

Inside diameter 11·1

15 + 11·1 X $1·5^2$ X 2·47 =

cubic inches =

12·6 X 2·25 X 2·47 = 70·

cubic inches
70 ÷ 2 = 35 cubic inches

in one half or 17½ lb

every turn 35 lbs

34 Rev. gives us 1200 lb per min

Always 1015 lbs in Spiral

Double thread round 12" pipe

1000 40
40000

Spiral pump

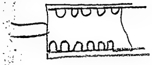
3 threads round 12" pipe

Weight

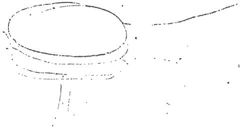
47/170 less $\frac{2}{27}$

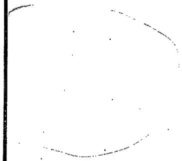
160 ft foot
13 4
480
160
40
2120

If we make a casting
and cut thread into it and
put on shell —



We could cast the
piece and it would weigh
about 556 lbs.





$8 \times 17 \times .6{\cdot}000 =$ Solid Content
Radiating S.
ft

12 X 12 X 4 = 576.00 46100

12 X 12 X 6 = 864

3 X 030 X 010 - 9000 72000

576
115
461

1000,000
1000000,000
1000,000,000

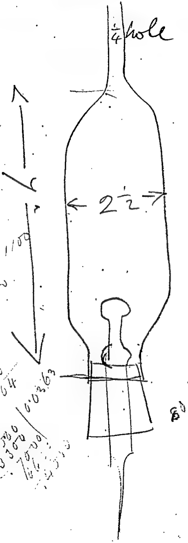
012
012
144

12 144
400
57600

300
50
90000
18000
72000

46100

72



110
1100

8.5

3.25

85 | 3.25 | 0.04
3.20
5

10

110 : 1100

110 : 1000

40

1000 | 40.00 | 0.04

1100 | 40.00 | 0.0363
33.00
7.000
6.600

80 | 20.0 | 0.25
16.0
4.00

Menlo Park Notebook #103 [N-80-06-29]

This notebook covers the period June-July 1880. It is a continuation of Menlo Park Notebook #42 and includes a summary of lamp experiments from that book. Most of the entries are by Francis Upton. There are also occasional entries by other laboratory staff members. Most of the book relates to experiments with bast fibers and, occasionally, with paper or bamboo. There are also notes and drawings relating to dynamo tests and to tests of insulation for electric railroad tracks and underground cables. The label on the front cover is marked "Upton." The book contains 282 numbered pages.

Blank pages not filmed: 278-279.

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Experiments to be made Page 275 –

R.R. Insulation 113-117

Table of bringing up lamps

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21
22
23 — 51
24 — 57
1225
26 — 79
27
28
29
30
31
32
33
34
35
36
37
38
39
1240
41
42
43
44
45
46
47
48
49

1250
51
52
53
54
5
6
7
8
9
1260
1
2
3
4
5 — 129 - 141
6 — 130
7
8 — 157 — 201
9
1270 — 197
1 — 177
2 — 179
3
4
5 — 185
6 — 223
7 — 227
8
9 — 175
1280 — 219
1
2 — 207
3 — 161
4
5 — 213
6 — 163
7
8 — 237
9 — 229
1290 — 221
1 — 233
2 — 241
3
4 — 249
5 — 245
6 — 253
7
8
9 — 275

60 3 ~~36~~ 9
20 1 1
18 cand

July 20

65	1.8129
15	1.1761
	.6368
	2
	1.2736
	.3010
37.5 candle	1.5746
66	1.8195
14	1.1461
	.6734
	2
	1.3468
	.3010
44.5	1.6978

Continued from Book 42

Goff Bast June 29

11.38 190 L.

3 1/2 Candles Blue scand

5000 ohms

Fine globules of Hg scattered through the globe.

44 candles

275 L.

Went at less than this

Monkey Base June 29

Resistance before bring-
ing up 790 Ohms
No. 12 14

2 candles

265 L

1.50 31 candles

328 L

Blue all through
lamp - changed to blue
at clamps

Monkey bash — June 29?

255 Left 20 cells = 43

7½ candles

blue all gone

She blue appeared at 8-9 candles very faint

272 L at 12 candles decided

2 44 candles, very blue

Cadin ½ minute

Regular Bost. Lamp. June 29.

2.15 Pump started.

Resist cold

6290
6290
6290
6250
6250
7580 ohms

200) 38870
194.35 Ohms

2,35 Heated

1/2 in below tube gauge

5-1/2 candles

250 Ω.

1/2 in below the tube.

6 1/2 candles

2,40	6290 6290 4600 17180 85.9 ohms 7 ½ candles 245 L.
2,41	~~284~~ 284 L.
2,42	280 L.
	37 candles blue on one clamp vacuum 2½ in up tube went to globe 44 candles

1.9031
1.9031
1.16464
100.7 7.9972
3.4498 2820

1.9031
1.9031
1.6464
7.9972
3.4232 2650 ft. lbs
16 1.2041
2.2191 165 ft lbs per candle

4.5185
3.4232
1.0953 12.4 per H.P.

Bast Reg. June 29

243 265 L
500

258. L.

29 Candles No blue whistle

16 Candles
6290
6290
6250
1310
20140 100.7
(2110 L.
80

14 candles

1500

232 L.ft

1500
6250
6290
6290
20330
101.6

(232
77.3

1.8882
1.8882
1.6464
7.9936
3.4164 2610
14 1.1461
2.2703 186 ft. lbs per candle

2.50 | 280

40 candles high vacuum
No blue - sealed off —
Thirty-five minutes from time
of starting pump
By very carefully looking
a very faint blue
could be seen

1211 Palmetto June 29

3-2	Lamp brought in
3-5	Started
3.30	58. Left.
	58. Right.
"	12000, ohms and all boxes in, when cold.
3.3x	5.½. candle,
"	306. R.
"	302. L
	6250. ohms.
	6250. "
"	6290. "
	6290. "
	5000 "
	2000 " 160
	32080

Palmetto No. 1211 June 29

3.35	7.½. candles.
"	4200. ohms.
	2000
"	8.½. candles.
3.36	4000. ohms
"	6250 "
"	6250 "
"	6290 "
"	6290. "
	2000
	300. L.
	300 R.

443000 5.6464
150 2176
3.4703
13 1139
2.3564
227

5000
25080
30080
150. Ohms

Palmetto No. 1211 June 29.

3.37	9½. candles
"	3050. ohms
"	2000 "
3.39½.	11½. candles.
"	300 R.
"	298. L.
"	5000. ohms
3.42	18 candles

Palmetto, June 29. No. 1211

3.43	298. L.
3.43	25,080. ohms.
	4900 "
3.44	348. L.
3.45	67.4. inches
3.47	65.3/4. "
"	18,830. ohms
"	6700. "

125536

127.6

$\underline{\overline{342}}$
114

	2.0569		
	2.0569		
	1.6464		
127.6	7.8972		4540
	3.6574		
44	1.6435		
	2.0139		

103 ft. lbs. per candle

Palmetto No. 12.11

	340 L.
4-20	44 candles
	342 R
4-45	Taken off sealed off. Very little blue in this lamp

170
2
340
113

2.0531
2.0531
1.6464
7.5638
3.3164
16.5 0.9294
2.3870

244 ft. lbs per candle

Willow June 29 80

5,38 7½ Candles

171 Lys

8 Candles

8½ "

171 L.

171 R.

37669
12000
5000
5,42 54669
273.

8½ Candles

170 L.

200/11769.4
2 2 8.9

William Carbons - Giri 29

5115	39 candles
	37669
	10000
	202 Gr.
	65 1/4 inches
	66 1/2 inches
550	37669
	9100
	30 candles
	195 G
	65 1/2 inches
	8500
	37669
	201 G

$2 \overline{)46569}$
2328

133	2.1239
	2.1239
	1.6464
	7.6345
	3.5287
46	1.6628
	1.8559

71.7 ft. lbs. per candle

66.5	1.8228
13.5	1.1303
	.6925
	2
	1.3850
	.3010
48.5 candles	1.6860

5-52 66¼ makes
200 " 133 Volts

8900
37669

(46569
232

5-55 Broke

This lamp quite blue
extremely hard to make

Summary Book 42 p114

Regular paper

Time	Candles	Total ft. lbs	ft per cand.	Ohms
1.50	16	4100	256	94.1
1-55	17	4130	242	92.7
2-	17	4010	238	91.4
2-7	19	4080	214	91.3
2-10	19.5	4000	205	90.3
2.14	21	4040	191	90.2
2.24	21.25	3990	188	90.
3-51	15.5	4060	262	94.9
3.52	16	4040	252	96.1
3-54	19	4100	216	94.6
3.55½	19.5	4081	209	95.5
3 58	20	4270	213	95.6

Lamp on Pump

Summary Book 42 page 175

Time	Bead Candles	fibre Total ft lbs	New Ft lbs per candle	Ohms
10-14	6			
	7			
	9 1/4			
10-18	12	2770	231	125.6
10-20	13.5	2730	202	121.6
10-21	14.7	2700	183	120.8
10-22	16.5	2840	172	119.1
10-23	17.5	2910	166	117.6
10-24	18	2960	164	117.4
10-25	20.5	2900	141	117.1
11-32	20	2860	143	116.

Summary Book 42 page 201

Best fibre

Time	Candles	Total Foot lbs.	Foot lbs per candle	Ohms
2	5.5	2520	460	121.7
	8	2570	321	119.4
	8.5	2770	326	118.9
	9.5	2800	294	117.1
	11	2820	257	116 1
2-7	12	2790	233	114.1
2-7	12.5	2500	232	110.4
	13.5	2820	209	112.4

Bast fibre 0".005 × 0".012

0".012 × 0".012 = 144 = c

0".005 × 0".012 = 60 = c'

$\frac{17}{2}$ $\frac{24}{2}$

0".034 0".048

0".012 × 0".012 = 144

44 candles

from 48 surface all round

X candles

from 34 surface

44 : 34 :: 48 : X

1.5315
1.6812
8.3565
1.5692

X = 37.1 candles

Let y = candles from side

Then

$12 : 5 :: 44 : y$

$$\begin{array}{r} 5 \\ 12\overline{)220} \\ \hline y = 18.3 \end{array}$$ candles from side

Energy from 0".005 X 0".012

39.1 parts

if 44 parts from 0".012 X 0".012

Resistance = $\frac{1}{60}$ of 0".012 X 0".005

Ra = $\frac{1}{140}$ of 0".012 X 0".012

Let z = E. M. F on 0".005

z_a ~~R~~ $=$

~~Ato~~

Const $\frac{a^2}{\frac{1}{140}} = 44$

Const $\frac{x^2}{\frac{1}{140}} = \cancel{60}\ 39.1$

Const $= \frac{44140}{140\,a^2}$

$x^2 = \frac{39.1 \times 60}{60 \times \text{Const}}$

$x^2 = \frac{39.1 \times 140 \times a^2}{44 \times 140}$

7

$x = \sqrt{\frac{39.1 \times 140}{44 \times 140}}\; a$

3

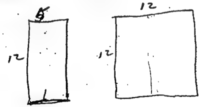
39.1
7
273.7

44
3
132

2.4362
2.1206
.3156

$\sqrt{2.06} = 1.4$

~~Double~~ 1.4 times The E.M.F for same candles



15

Resistance cold

37,620
12,000
35,000
84,620
423 Ohms.

31,370
6,250
37,620

1½ to ball

1/100 of resist. read

25080 175 L.
7300

195 L.
18 Candles

25080
3300

Bast 5x12 June 30-80

190 Ω

17½

192 Ω
18 candles slightly
blue - not so blue as others
at 44 C-Edison

Turned face to
189 Ω
13 candles
3700

18
44
(62
31

201
2
(402
134

44 candles ~~[illegible]~~

2.1271
2.1271
1.6464
7.5482
3.4488 2810
34 1.4914
1.9574
90.5 ft lbs per candle

No 1223
Bar 5 x 12 June 30

2950
25080

19½ candles

200 Left. not much blue not so much as others at 44 — Edison
280 ohms Hot

18 candles

203 L = ω

25080
3300
283.

200 R = ω

6.0 :: 144 :: 105

$6\overline{)1440}$
240

144
105
720
144
$6\overline{)15120}$
252

at 44 candles.

B.P.	Ohm	H.Ms. per candle
Palmetto	127.6	103
~~Batt~~	99.6	101
0".012 X 0".012	107.6	90.5
0".005 X 0".012	283.	90.5
0".012 X 0".012	106.6	93.1

46 candles

Willow	232	71.7

Bast 5-412 June 30 - 2nd test

10-20	Started pump
	37620 22000 Resist cold.
	½ in. in tube
11-	Heated 130 °
11-3	Good vacuum.
11,12	Lighted 1 candle
	25080 7350 ✓
	130 Lgt

170 °

4½ ca. [illegible]

3 in from lt.

67.6
2
1352

250

31

2.1309
2.1309
1.6464
7.6021
3.5103
1.4914
2.0189

102 ft lbs per candle

2nd test 0".005 X 0".012 No. 1224
Bast 5 x 12. Inu 30. 2nd test

11-18 188 L.

7 3/4 candles

155 R.
157 L.

25080
2300 } – very faint blue

11 22 203 L.

1.8 Candles

25080

11-30 Broke

87 1.9395
1.9395
1.6464
81.0685
3.5939

3920

Galva 3920 ft. lbs
Calor 3810 " "

5939
5807
.0132

1.03 %

20 cells 65 R & G

1-29 Temp. air 85° F.

1-30 Started

Temp H_2O 72°.25

85
72°.25
12.75
85
97.75

6290
6290
4500
17080
85.40

1-33 261 R = D
260 R = D

87 Volts

1-35 4450 Ohms
260 R = D

1-39 Stopped 96°.5 F
72.25
24.35

1.0515 Kilogramme

2.204 lbs to 1 Kilo

44.5 ~~Gramme~~ Comp

203 Cu Vessel
44.5
247.5

1.0515
.2475
.8040
20
.824
2.204
775
Comp 9
24.35

7.9159
0.3432
2.8893
9.0458
1.3865
3.5807

3810

Current put on suddenly
and broke carbon

Pump became very dirty
and Hg ran back
into lamps.

Book 63 page 37

A filament of manilla carbon estimated as 0".005 in diameter 2".4 long
resistance cold 505 Ohms
resistance 62.490 Ohms per mill foot
or 5.207 per mil inch

A Bast fibre 0".012 X 0".012
195 Ohms cold
85.190 Ohms per mil foot
7,099 " " " inch

Manilla	5.207	per mil inch
Bast	7.099	" " "

0".012 X 0".012

Comparison 0".007 X 0".012

Book 63 p. 150

0".007 X 0".012

at 27 ~~candles~~ corrected for

two sides

27 candles

142 ft. lbs per candle

0".012 X 0".012

Book 42 p. 239

29 candles

132 ft. lbs. per candle

Box of Cells 1	211 = D	
2	211	
3	211	
4	213	
5	211	

Standards all good June 30, [illegible]

1.9375
1.9375
1.6464
74.4 8.1273

3.6487 4450
41.5185

.8698 7.4 per H.P.

3.6487
1.5051

2.1436

140 ft. lbs per. candle

1260 = D
86.6

6290
6290
2350

14930

74.6 Ohms

32 candles

Bast fibres

$0''.005 \times 0''.012$ July 1.

Very bad spot in ~~one~~ side.
extremely ~~blue~~
went immediately

20 cells = 43
1 Volt = 2
Resistance 100 times

10.44 5.3¼ c

" 31,370. ohms. 403.7 ohms
" 9,000.

" 260. L.
" ½ 262. R.

Very faint tinge of blue
on top.

Bast fibre July 1. Fo.
0".005 x 0".012.

10.48 8. 3/4. candles.

10.50 312. L.
316. R.

Very high vacuum.
At the top of the
lampa a bad spot
and blue around it.
The lamp when it
broken was filled with
blue. One side of carbon
incandescent the other
red with red clamp.

1600 : 2454 :: 80

80

196320

122 Volts

5' 2930

3' 2041

2.0889.

July 1. 80

Wrought iron motor

92 Volts running 11 lamps

94 Volts all lamps off

100 Volts after short time

.1227

2

2454 revs p.m

200 Volts on magnet

115 Volts from armature

when stationary

7½ permanent

102 Volts no lamps

92 Volts on lamps

18 ohms in with magnet

90 volts

11-40 32 ohms in with magnet 88 Volts

12-5 86 Volts

July 1 - No 1226

Bast fiber 0".005 x 0.012

11.45 37600 / 22000 } No color

Quite anemone carbon

31370 / 9400 }

268 L.

5 Candles

5½ Candles No blue

11.52 31370 / 8800

275 L.

8½ C.

Bast 0.005 by 0.012 July 1-80

11.55 8000
31370

13 C
very faint blue

278 L.

7000
31370

12 — 15 C. blue all through globe

295 L.

6000
2 31370

Sealed off —
Tried resistance box
30.1 Ohms = 30100

Clamps large

14½ candles

190 L.

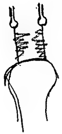
1	8	8	30
	5	9	00
2	4	7	30
1	2	3.	

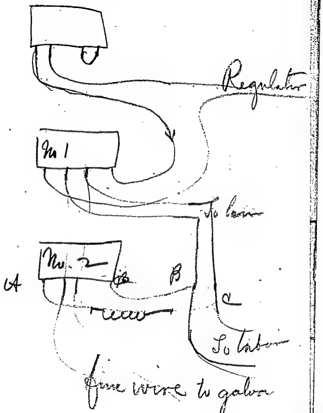
210 L. Very blue
210 R 65 inches

175 L.

14 candles very slight blue, small bad spots in carbon, a little Hg in bulb

Clamps




Regulator
No 1
No. 2
A
B
C
fine wire to galva

1100

~~314~~ 157 $\frac{10}{12}$ 6

6) 157
2.6
1100
26 00
26
280 00

55 00

~~400~~
400
160000
44
640000
64
2) 7,040,000
20) 3,520,000
176000

33000
5
165,000

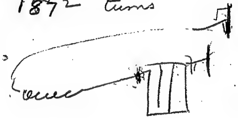
20 39
6
234 turns on frame
small machine wrought in
75 volts at 1600
since then E. E. [illegible]
5500 r.p.m. the [illegible]

be about twice as strong

234 : X :: 75 : 600

$$\frac{\frac{3}{4}}{6} = \frac{1}{8}$$

$$\begin{array}{r} 234 \\ 8 \\ \hline 1872 \end{array}$$ turns



Webers

185
19
375
524

.0715
.0687
1402
.0701

1.5740
2.7193
8.8547
$\bar{2}$.8373

141
13.6
.07
9.52

149
16.3

Plan of arrangements
~~page~~ 87

18.5

On magnet ~~79~~

Total 262
263

20 cells = 65
65

From M ~~1~~ 41 L
41 R

No 2 49 L
49 R

$\frac{\sqrt{66.7}}{22.2}$

$\sqrt{51}$
17
.07
1.14

4-34	No. 2	66.5 L
		67 R
	No 1	51 R
		51.5 L
4-42	No. 1	53 L
		52 R
	No. 2	69 R
		69 L

4

$\frac{67}{22.3}$ .07 1.561

$\frac{96}{32}$

$\frac{80}{26.6}$ .07 1.862

$\frac{118}{39.3}$

	No. 2	80	
	No. 1	42	
	Magnet of No. 1 broken		
	No. 2	82	L
		82	R
	No 2	96	R
	No 1	67	
4-50	No. 1	80	
	No. 2	118	

$\dfrac{100}{33}$
.07
2.31

$\dfrac{148}{49.3}$

$\dfrac{155}{51.6}$
.07
3.612

$\dfrac{220}{73.3}$

$\dfrac{220}{73.3}$
.07
5.131

$\dfrac{267}{89}$

22	1.3424	
320	2.5051	
.0687	8.8373	

No. 2 148
No. 1 100

No. 1 155
No. 2 220

No. 2 267
No. 1 220

One magnet 22
On line 320

Changed by taking
the resistance out of
the line with
No. 2 355

$\frac{118.2}{3.06}$

97

Now Three Ohms
in line with magnet
of No 2

Now
Fixed so that magnet
is in direct line to galva

No. 2 = 270
On magnet 16 L
15.5 R

17.5 R
Magnet 18.5 L
18. R

Armature 291 R
292 L

Armature 316 L

Magnet 24 L
23 R

1048 revo.

~~Armature~~ ~~36 R~~

Magnet 40 L
40 R

Armature 370 R

Armature 333 R

Magnet 27 R
27.5 L

---

20 cells made 43 L
42.5 R

Magnet 35 R
36 L

Armature 248 L

Armature 25.5 L
Magnet 48 L
47.5 R
Armature 25.4 R

Short circuiting gave
150 Volts
145

233 convolutions
6
1398 Convolutions on magnet

20 Gammu
8
28 H.P. gives 37 burners

Regular bast ~~[illegible]~~

12	16 candles	101. Ohms	165 ft lbs per candle
13	14	"	186
35	~~14~~	~~Ohms~~	~~183~~
	~~16.5~~	~~120~~	~~172~~

Palmetto 150 Ohms

page 20 13 candles 227 ft lbs per candle

Bamboo

171. 5.6664 15 candles
7.7652
3.4316
1.1761
2.2555 182 ft lbs per candle

July 13

15 candles

6250
6250
6290
6290
9200
34280

171. ~~[illegible]~~ Ohms

.308 = v on H.R

102.6 Volts

102.1 2

2.0100
2.0100
1.6464 5.6664
7.9172
3.5836

15)3830(255
30
83
75
80

Bamboo Fibre 0".012 X 0".012

2-14	48 candles or 66.5 inches No blue
2-25	Stopped to Exper Started again about 1/2 minute
No. 1262	Lasted about 1/2 minute

Both went in the clamps no cross conductor from fibre to fibre

11 1/2 minute

1150 Ohms Total
5.0 Ohm Conductors
6.5 Ohms one side

7.75
5.
2.75 Ohm One side

7.25 Both sides
2.5
4.75
~~2.75~~
~~7.50 Ohms~~ Each

6.5
2.75
9.25
4.62

6.5
2.75
9.25

Insulation R. R. July 13.

~~4000~~
~~200~~
Track to track 10 Ohms

2300
200 One track to ground.

2950
200

1550 both tracks
200

More current

1450
200

4000
200 = 20 Ohms
10
10 Ohms

Conductor $\frac{2020}{200} = 10.1$

Results

resistance on wet
lay from track
to track
10 Ohms

One side to ground
6.5 Ohms
Other 2.75
9.25 Ohms

Both sides
4.5 Ohms

[illegible]

20
.15 3/4
20

365
15
1825
365
5,475 10
547.

25.
600.
15000.

15 M

15) 461 (.30 cts
45
110

30
4.7
34.7
8.6
26.1 cts

Estimate

600 Lights. 3½ lbs of coal per H.P. in the current.

Five hours.

6 lights per H.P.

100 H.P

7 350 lbs of coal an hour
35 5
~~175~~ X 1.65
~~224~~
45

1.65
7
9) 1225
1.36
.25
3.00
4.61

Oil & waste .25

Engineer 3.00

Money invested

6.500

Depreciation 4%

6,500.
.04
365) 26000 (.071
2555
450

15) .71 (.047
60
110

Bamboo Jehl's tests

※ 3808 ft. lbs. for 17 candles

Resistance 114 Ohms

3808 / 17 . 3.5807
1.2304
2.3503

224 ft. lbs per candle

3842 / 16 3.5845
1.2041
2.3804

240 ft. lbs per candle

※ Book 104 page 28-29

Lamps No. 1253

Galva

83.3	1.9206
8	1.9206
	1.6464
86.4	8.0635
	3.5511

3560 ft lbs

10-27 69° 7

Started

Temp. air 81
69
12
81
93

250 R
~~2~~49 L

3(250
83.3

6290
6290
4760
2(17280
86.40 ohms

92.125
69
23.125

10-37 92°.125

3560
3280

3.5511
3.5159
0352

1.08 %

.831 9.9196

Page 61 0.3432 |||

2.8893

Comp.10 9.

23.12 1.3638

3.5159

Calor 3280 ft. lbs

Wt. of Vessel & H_2O

1.058 Kilo

.247

.811

20

.831

74.3 1.8710
1.8710
1.16464
89.9 8.0462
Galva 3.4346
ft. lbs. 2720 .4116
.0230

1.05 %

Calor. & Galva.

11-22 70°.57
Started

82
70.5
11.5
82
93.5

223 = D
74.3 Volts

6290
6290
5400
17980
89.9 Ohms

11-35 93°.97
11-22 70.5
13 23.4

Calor & Galva.

1066 Grammes
247
819
20
839 — 9.9238
6.3432
2.8893
Comp 13 8.8861
23.4 1.3692
~~Calor~~ 3.4116
2580 ft. lbs

.84   1.9243
1.9243
116464
71995 7
3.490 7   3100
16   1 204 1
.2966

198 ft. lbs. per cand

~~Bamboo~~ Bast $\overset{0''.012}{\times 0''.012}$ Ends diffed in Pt. solution
Fibre — No. 1265

16 candles

6290
6290
6250
1200
20030   100.15

252 L
252 R
8.4 Volts.

101 2.0043
2.0043
1.6464
141 7.8508

3.5058 3204
18 1.2553

.2303
178 ft. lbs per candle.

Bast 0".012 X 0".012
~~Bamboo~~ Fibre No. 1266

~~17.25~~ Candles
18 candles.

6250
6250
6290
6290
3420

28280 141.4 Ohms

303

101 Volts

1.9926
1.9926
1.6464
140 7.8539
3.4855 — 3060
15 1.1761
.3094

204 ft. lbs. per candle

Bush No 1266

0".012 X 0".012

15 candles

$\frac{1295 = D}{98.3 \text{ Volts}}$

~~Same resistance about as~~
~~before~~

140 Ohms

111.6

126.6

4300

2.0477
2.0477
1.6464
7.8975

3.6393

4300
8

34400

Burst No. 1266 0".012 X 0".012
Soaked at clamping part
in double chloride NH_4
Pt. Book 57 page 155

~~44 candles~~ 66.5 inches
48 candles on bar

2-51 Started

Not much flame

6290
6290
6250
6500

25330
126.6 Ohms

1335
111.6

3- Went very suddenly clamp
red hot

9 minutes

4.5185
3.4413
1.0772

12 per, 11

2
2
42 1.6464
160.4 7.7949
3.4413
2760 1.2041
.2372

172 ft. lbs per candle

~~Rattan~~ 0".012 X 0".012
Bamboo

16 candles 1

3 ooo = D 17 candle Edge

6250
6250
6270
6290
~~7000~~
32680
160.4

2.0607
2.0607
1.6464
7.8374
3.6052 .4030

Bamboo 0".012 X 0".012
regular size

3-15 66".5 ~~ohm~~ bar
or 48 candles

$\frac{345}{115} = 0$

4000
6290
6290
6250
6250
129080 145.4

3-24 Went out

Black on clamp carrying

9

Bask No. 1265 July 14. 80

Reversed current

4-14	Started 48 candles
5-55	Broke
$\frac{4\text{-}14}{1\text{-}41}$	$1^h\ 41'$
	$\frac{60}{101}$ minutes

Slightly darkened the glass [illegible] lamps

July 16 -

Test insulation of lines underground

Conducting wire

200/25.20
12.6 Ohms

18 wire circuit
6290
7820
(141 10
70.5
12.6
57.9 Ohms insulation

Carmen circuit

(2800
1400 Ohm
12.6
1.40 Ohms

With ground
~~1.9~~ Ohms
2900

$\boxed{\frac{8000}{200000}}$

$$\frac{\times 7}{14000}$$

Carmen Circuit

One side

20) 21 0.0 Ohms

1 0.5 Ohms other side

6.3

4.2 Ohms / 12.6

6.3

4.2 Ohms to ground

2) 2900

14.5

6.3

8.2 to ground

Insulation conductors

6 wire circuit

6290
6290
2300
14880
74.4
12.6
61.8

One side ground

	other
6290	6450
100	3225
6390	6.3
31.9	25.95
6.3	25.6
25.6	50.5

Insulation conductors

Edison's lines

One side with ground

2 | 24.20

12.1

6.3

5.8 Ohms

| 3.150

15.7

6.3

9.4

5.8

2

| 2850

14.25

12.6

1.65 Ohms

Insulation Conductors

Page 145 conducting wires from galvanometer 12.6 Ohms
18 wire circuit

6290 6290 900 13480 67.4	67.4 12.6 54.8 Ohms

More E. M. F.

6290 6290 200 12780 63.9	63.9 12.6 51.3

One side with ground

6290
31.45
63
25.15 Ohms

Other side

6290 2300 8590 42.9	25.1 42.9 68.0 Ohms

July 16 1880

	Wire to wire	ground	
	Ohms	Ohms	Ohms
18 wire circuit	55.	25.	43.
Carmen circuit	1.4	4.2	8.2
6 wire circuit	61.8	25.6	50.5
Edison's line	1.6.	5.8	9.4

The weather has been raining for two weeks and the ground is thoroughly wet. Houses on Edisons and Carmens circuit.

Lamp No: 1268 Bast
Reversing current

11-43	Very rapid reversal Reverser N. G.
	(3150 1575 Edisons line 126 House off main 3,15 Ohms

Conducting ~~circuit~~

Carmen's July 16

2. P.M. $\frac{2950}{147}$ 4 P.M. same

12.6

2.1 Ohms

One side

$\frac{3000}{15.00}$

6.3

8.7 Ohms

Other 8.95 Ohms

2.0277
2.0277
1.6464
7.7878

3.4896 3080

Lamp 1283 Bambo

16 candles

62.50
6250
6290
6290
7650

32730

163.6

163.6 Ohms

3.20 = 0

106.6.

Lamp 12.8 Bamboo

	44 candles
3-34	Less than 8 minutes
	Nos. lamps in case
	1274 Bast fibre ends soaked Book 57, p 159
	1268
	1271 Bast fibres
	1270
	1272 Book 57 157
	1275 Bast
	1269 Bast Book 57, 135

Larmen's line

2850.
1425
12.6
1.65 ohms

1800
9.
6.3
2.7

1800 Ohms
9.
6.3
2.7

P.M. 2900

Gas jet July 17-80

Gas jet	Ground glass
13	11
12.5	10.5
12.5	10
12.75	11
13	11.25
5) 63.75	5) 53.75
12.75	10.75

E L

Large Ground glassglobe

12.5	9.75
12.5	9.75
14	11.5
39.5	31.00
13	10.3
8	
	0.9031
39	1.5911
5	93120

20%

26

6290
2
12580
6250
18830
3500

20) 22330 (111

28
30

3)285
95

9.5 1.9777
1.9777
1.6464
7.9547

~~3.5975 3900~~
3.5565 36 ans

18830
3500
210) 21830 (109
1830

2 6 9 = 10

Rs 6290 × 2 + 6250 + 3500 = 111 dhs

Def 285 at 12.20 C

Def 295 Res. 109 ohms
at 16 C

at an angle of 45 it gave 19.6 at 90° it gave 14

July 17-80

In Frosted globe

[illegible]

295 = D

293 = D

14

14

12.5

80
66.5
13.5

No 1279 Beast

$\frac{253}{1.5}$ Volts

44 candles

2-41

6290
6290
7990

3-5 Went at clamps in glass cracked

14 minutes

P

Port

Francis

Portland

~~30~~0
15

Bost
Lamp No. 1271

3-19	Started
	255
	44 candles
	6290 X 2 + 6000
	6290
	6000
	18580
	929 Ohms
	Ohms
4.21	Busted
	2

Bast
Lamp No 1272

4.31 at 44

433 Inslick [illegible] [illegible]

Lamp 1270

319
106.3

2.0265
2.0265
1.6464
79.9 8.0975
3.7969

6260

.463 9.8938
0.3432
Page 61 2.8893
19.5 1.2900
comp 4.5 9.3468
3.7631

5800 ⑧

3.7969
3.7631
.0338

1.08%

Galva & Calor

Temp air 77° F

10-8 Started
Temp H_2O
67.4

319 H. R

R = 6290 6290 3400 / 15980 79.9 Ohms

10-12-30 Temp 86°9 F
86.9
67.4
19.5

1010 Grammes
247
763
20
783

100 R

70 x

$70 : x :: 100 : R$

$x = \frac{70}{100} R$

Bucket of Tar July 19

~~180~~
70
100

6290
4
25160
25000
12000
7 | 62160
7
43518 Ohms

Wrong this is an estimate of galvanometer Tar with plates then

20000
4000000

needle did not move when current passed through with all resistance out on other side. The tar seems to be all right

1.8954
1.8954
1.6464
7.9890 2670
3.4262
7.12 9.1475
2.5737 375

Bast No 1275 July 19

7 1/8 candles

65 = 20 cells

235
237 (236
78.6

R

6250
6290
6290
1900
(20530
102.65 Ohms

1.9101
1.9101
7.9864
11.6464
3.4530 2840
8.6 0.9345
2.5185 330

Bast No. 1275 0".012 X 0".012 July 19

8.6 candles

244
244
81.3 volts

6290
6296
6250 18830
1820
20650
103.25

1.9207
1.9207
1.6464
7.9898
3.4776 3000
9.8 0.9912
2.4864 306

16 33000 4.5185
8
128
2.1072
2.4113
258 ft. lbs per candles

9.8 candle

250 H.R
83.3

18830
1650 Ohms
20480
1024

~~2.0255~~
~~2.0025~~
1.6464
1.9375
1.9375
7.9946

3 ~~2961~~ ~~1970~~
~~1.1461~~
~~2.1500~~ 3320
3.5210
1.1461
2.3749 237

14 candles

1260 H.R
86.0

18830
1300 ohms
120/30
100.6

1,9474
1,9474
1,6464
8,0039

3,5451   3510

Bust 1275

175 candle

266
88.6

1000 Ohms
18830

19830
99.15

2.0055
2.0055
1.6464
8.6487

3.7061 5080

Bast 1275

148 candles 66 1/2 inches

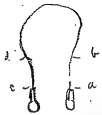
8-40 | 304 101.3

6290
6290
5300

17880

89.4 Ohms

8-53 Broke 13 minutes



Lamp black

a-b, c-d black neat steel color

1.9694
1.9694
1.6464
7.9028

3.4880 3080

Bast No. 1270 July 20

Very regular

17.5 candles

280 = D
281R = Ш 73.2
6250
6290
6290
6200

250 30

125.15 Ohms

2.0386
2.0386
1.6464
7.9431
3.6667   4640

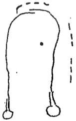
Bast No 1270   July 20

48 candle

9-20   328
109.3

6250
6290
6290
4000
22830   114

9-27   Went   7 minutes



Black

Clamps black

1.9411
1.9411
1.6464
7.9578

3.4864 3060

Bart 1268

at red

1278

Brightest spots marked outside

15.5 candles

(262
87.3 Volts

6250
6290
6290
3300
22130
110.65

Boat 1268

Last one minute

Broke in two places

Book 57
√1282 Bamboo p 163
1283 Dipped Chl Pt
1284 0."012 X 0."012
√1285
√1286 Bamboo 0."012 X 0."012
√1287 Ends $\frac{3}{32}$" wide
√1288 Bast syrup
√1289 Book 57 p 163
1290 Bamboo ~~Bast~~ 0."012 X 0."012 p 165
Ends $\frac{3}{32}$
1291 Bast p 165
1292 syrup
H ends
1293
Bamboo 0."012 X 0."012
1294

1295 Carbonized flat ways
Ends 3/32 p 167
1296 Bamboo regular
flatways p 167
1297
1298 Bamboo
1299 st. Dr 10oz

1,9685
1,9685
1,6464
7,9281
3.5115   3250

at red perfect
Darker some distance from
clamps

1.6 candles

(279 = D
9/3

6250
6290
6290
4800
236.30

118.15

On one side white hot
into the clamps small piece
broken off and leaves a filament
as black. Other side red
into clamps

2.0346
2.0346
1.6464
7.9788
3.6944 4950

10-18 44 candles
325 = D
6290 108.3
6290
8400
20980
104.9 Ohms
The light for a time was somewhat lower and for a time 333 = D The engines varies considerably

~~11-18~~

11-18 Stopped to test lines
Edison took away to examine

2.0067
2.0067
1.6464
8.0398

3.6996 5010

5000 / 33000 (6.6

10-1 86.5 inches
= 48 candles
No blue
305
101.6

6290
6290
5670
18250
91.25

10-23 Went at above clamps

523 2.7185
132 7.8794
20 1.3010
1.08 0.0334

85.5 1.9323
1.9323
1.6464
7.9605

3.4715 2916

~~Bast~~ Bamboo No 1299

Pt. Ir 10% foil around carbon at clamp —

0".012 X 0".012

16 candles

6290
6290
6250
3100

21930 109.6 ohms

Ru cells 65
67

132

260
263

523

400
300
220

1.9850
1.9850
1.6464
8.0128
3.6292
4.5185
.8893

4350 ft. lbs.

7.75 per H. P

Bamboo No 1299

4-12½ PM — 48 Candles

290 HR
96.6

6290
6290
6250
600
19430
97.15

4-50 Blue flame at the clamps

5-5 Went

60
12.5
97.5
5
52.5

13.5 candles

17

$\frac{350}{116.6}$ 2.0662
2.0662
1.6464
205 7.6882
3.4670 2930
4.5185
1.0515

11.5 per H.P. of 17 fence

Regular paper old model
No 1280 July 21.

Gum spots not very marked
£76 duplicates

17 candles
6270
3
24870
6250
.6250
3800
47170 205

$\frac{175 + 175}{1.5+}$

7½ candles edge

2.0952
2.0952
1.6464
7.8013

3.6381 4340

Paper No 1280

66 1/2 inches on bar

9-29 $\frac{1202}{67.3} = 0$

67.3
2
124.6

6290
6290
6250
6250
6500

9-32 $\boxed{31580}$

157.9 ohm

1.9542
1.9542
1.6464
127.6 7.8935
3.4483 2810

Bamboo No. 1286

0".012 X 0".012
Ends $\frac{3}{32}$"

15 1/2 candles

290
90

6290
6290
6250
6250
~~44~~50
25530
127.6 Ohms

2.0224
2.0224
1.1646 4
7.9494

3.6406   4307

Bamboo No 1280

66″ 1/2 in ba—
Some blue in lamp

10-48 | 316
| 105.3

| 3650
| 6250
| 6290
| 6290
| 22480
| 112.4

11— | Went

Bamboo No 1287

Good carbon
66½ inches or
48 candles
went in one minute
very high resistance

1.9850
1.9850
1.6464
7.8465
3.4629 2900

Bast 1289
poor vacuum oxydized

Bamboo
No 1290

Bad ~~spot~~ in bottom of
loop for 1/2 inch (thin) –

16 candle

290
96.6

9650
6250
6290
6290
28480
142.4

2.0306
2.0306
1.6464
7.9103
3.6179   415-0

Bamboo
~~Boot~~ No 1290

148 candles 66.15

11-20 $\frac{322}{107.3}$

6250
6290
6290
5750
$\frac{24580}{1229}$

11-25 Went

1.9854
1.9854
1.6464
7.8894
3.5066   3210

Bast
No. 1291

15 1/2 candles

292
290   96.7

6290
6290
6250
7050
25880
129

2.0453
2.0453
1.6464
7.9531
3.6901 4900

Best
1291

11-33 66½ [illegible]

333
111 Volts

3450
6290
6290
6250
22280 111.4

11-45 W ~~ent~~
33
12

1.9939
1.9939
1.6464
7.8511

3.4853   3050

Bact 1288

bad place

16 candles

296

98.6

9356
6250
6290
6290

28180

140.9

2,0569
2,0569
1,6464
7,9211
3.6813 4800

2.0477
2,0477
1.6464
7.9156
3.6576

4540
4600
9340
4670

Bast 1288

11-56

86"5

342
114

5150
6290
6290
6250
23980
119.9

~~Again~~

5450
6290
6290
6250
24280
121.4

335
111.6

12 — Went

Clean breaks on one side

1.9850
1.9850
1.6464
7.8636
3.4800   3020

Best No 1292

Bad places

16 candles

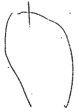
~~290 96.6 Volt~~

18830
8550
27380   136.9

Slight blue

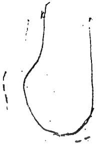
Bast no 1292

	48 cand
12-9	337
12-11	Went This was brought somewhat higher than 44 candles
	At top



2.0306
2,0306
1.6464
7.8164
3.5240   3340

Bamboo
No. 1295 Carbonized —
Platinum



15 3/4 candles

322
107.3

5450
6250
6250
6290
6290
30530
102.6

Bamboo

No. 1295

66 ½ inches

Very high for a moment went

About 1 minute

2.0140
2.0140
1.6464
.717997
3.4741   2980

No. 1294   [illegible] 2½
Bamboo

Label

16.25 candles
310 = N
103.3

6650
6250
6250
6290
6290
31730
1586

a little blue in globe

No. 1294 Bamboo

66 ½ inches
44 candles

2-10 Went at top
2 minutes about
Very carefully brought
up so as not to exceed
48 candles

Bamboo
No. 1296 flatways

Good carbon

15.5 candle

~~4~~4300 No Galva
6250
6250
6290
6290

29380
14.69 Ohms

2.0346
2.0346
1.6464
7.8749
3.5905   3900

Bamboo
No. 1296

2-24   86.5 inches 48 candles
Very carefully brought up so as not to exceed 48 candles.
1600
6290
6290
6250
6250
26680
133.4

325
108.3

2-50   Went
24
26

Bamboo No. 1300 July 21

Reversed current

4-37	48 candles
4-41	4 minutes
	This showed ~~a bad~~ a bad spot at the bottom. With constant current should not expect it ~~to last~~ more than one minute.

Bart regular 0".012 X 0".012 X 4" Jul 21 80
Reversed current

4-47 | 66.5 inches
48 candles

Should expect to last less than ten minutes as it had a bad place

5.7½. went.
13
20½ minutes

1.9460
1.9460
1.6464
7.9338

3.4722   2920

No. 1312

Jap. Bamboo   V = 112

Slightly thin

16 candles   slightly

4450
6250
6290
6290

23280

116.4

265 = N

88.3

2.0182
2.0182
1.6464
7.9605

33

No 1312 July 22 1880

9-6 48 candles 66½ inches
Globe very blue

6250
6290
6290
3000
218.30
109.15

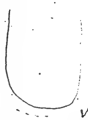
313 = Δ
104.3

before 9-17 blue entirely left the lamp.

9-21 Went slightly
more than 45 candles
No carbon on clamps
15 minutes

No 1311 July 22-80

Jap Bamboo



very slight brightness

16 candles

an extremely faint blue in lamp

$$\frac{265 = \Omega}{88.3}$$

3700
6250
6290
6290
22530
112.6

Lamp No. 1311

Jap. bamboo July 22

One side in clamp broken

10-57 48 candles

Very blue completely filling globe

32 ∅ = D

6290
6290
6850
800

11-11 E. M. F constant

First a flickering blue then entirely clear

11-17 W cut it short

None deposition on clamps very high vacuum.

20 minutes

No. 1301 Feby 5 5
Extremely good carbon
Bamboo Regular

V=112

Reversed currents
48 candles

11-28 | 213 = D

blue in globe
Higher than 48 candles

11-46 | Blue in globe disappeared

11-54 | Went

This lamp had run up much higher than 48 candles on account of reversing key running slow

Bamboo

2-8	Reversed currents
	212 = D
	48 candles
	Quite blue
2-21	Went in ah spot

Bamboo
reversed currents

~~4-14~~	Very little blue good carbon Big mistake went very high
4-14	48 candle 66.1/2 in
4-18	Went

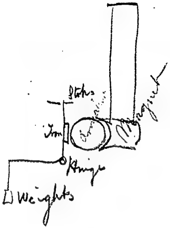
Edison

Pt. Iridium .005 . 16% to
be brought up to one
candle or less in the
air ; ~~exhaustion~~ then measured
as the air is exhausted
Edison

Carbons to be sealed in
small and large globes
and carefully measured
then lifted and measured.
5 of each kind Edison.

Lamp to be sealed with
MacLeod gauge and
~~vacuum~~ tested from
time to time Edison

for ~~armature~~ without wire on the armature, to be held
in front of a magnet
and the magnetism in
it tested.



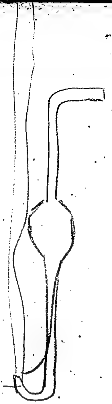
Try the weight at rest and in motion.

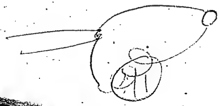
Edison

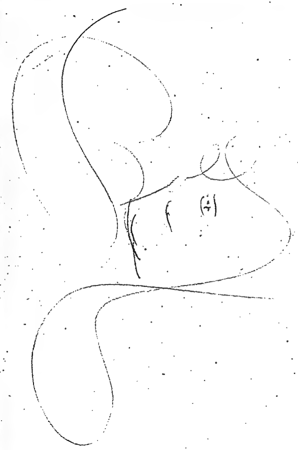
Test relation between magnet and armature of both machines and small wrought iron motor

---

281







Menlo Park Notebook #104 [N-80-07-05]

This notebook covers the period July 1880-February 1881. All of the entries are by Francis Jehl except for one drawing by Edison of a lamp with a spark gauge. Included are notes, calculations, and drawings of lamp and vacuum pump experiments; notes on motor and dynamo experiments; and notes and calculations about meter experiments. There are also notes and calculations relating to battery tests, resistance tests for wire and electric railroad track, tests of copper wire, and tests of insulation compounds. The label on the front cover is marked "Francis Jehl" and "1880." An index has been pasted onto the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 202-203, 216-221, 224-229, 248-249, 260-261, 264-269, 274-275.

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" — (Pa[illegible]) 30, [illegible]7
" — (P. P. [illegible]) — 24, 66.

Exp. 1.

Made a very [illegible]

solution of [illegible] and

[illegible]

paper [illegible]

[illegible] the

being [illegible]

[illegible]

[illegible] went to

look at it, I found that

it was broken [illegible]

dont know, I noticed

that one of the [illegible]

was black. I put [illegible]

new carbon in [illegible]

Index

Calculations — 16, 17, 19, 20, 21, 22, [illegible], 26, 27, 28, 29, 32, 36, 3[illegible], 39, 42, 46, 47—58, 64, 66, 67, 7[illegible], 79, 102, 110, 111, 11[illegible], 116—121, 123, 124, 125, 126, 127, 129, 131, 133, 135, 137, 139, 141, 143, 145, 146, 147, 148, 149, 151, 153, 155, 157, 159, 161, 165, 180, 181, 182, 1[illegible], 186, 1[illegible], 189, 190, 191, 192, 193, 195, 196, 198, 199, 201, 204, 205

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" — (Bamboo) 25, 28, 32, 34, 57

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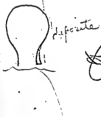
" — (F. R. crack) — 44, 66.

Exp. 1.

Made a very [illegible] solution of [illegible] acid got six [illegible] of Bichromate battery. made to [illegible] [illegible] in clamps and put the battery on to it, it being [illegible] put in the solution. In the evening I went to look at it, I found that it was broken how I dont know, I noticed that one of the clamps was black. I put a new Carbon in again

[illegible]
[illegible]
In the [illegible] (July 6)
I looked at it again and
there was a thin carbon[illegible]
~~at the~~ on one of the clamp
(the fine end).

Ex 2

Made a diluted solution
of Copper Sulphate +
took a carbon in clamps
and put it into it, and
put one cup of Daniells
on it. let it worked
all night [illegible] in the
morning there was a
deposit on the carbon


as shown in the
figure.

OK4 July 6 1880

[illegible] some [illegible] clean [illegible] by [illegible] some [illegible] and the [illegible] night (in a [illegible]) had a special pump made that carried the results of [illegible] with a special lamp (the fall tube from the gauge so as to have the lamp and gauge in one place, and to Charts watched o[illegible] how much the gauge would fall, while the

Lamp was burning.

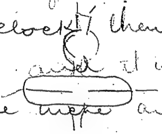
I put in one of the ~~[illegible]~~ Lamps, specify as the "monkey grass" Lamp just fifteen minutes past one and at twenty minutes to three it was ready to be sealed from the fall tube called Mr Edison and on coming back found the Lamp busted. I then immediately put on another Lamp this time one of the regular and at five it was ready to be sealed off from the fall tube. after being sealed it was

watched by Mr Edison
and myself and the
vacuum fell from one
which was very good
before started, being about an inch from the top lot one which
was very bad being way
down in the wide tube
of the gauge.

No 5 July 7 1880

Got a pump made which
could only be read
off from the gauge as
before, the lamp being
sealed direct (this time
to the pump, (no stopper used)
commenced half past
eleven ~~twelve~~, heated the lamp
at about five minutes
to twelve, kept pump running
all through noon, got a
very high vacuum, (very good)
after dinner heated
it up again and

at about two oclock
we sealed it off.
Had not all this [illegible]
[illegible] we kept
of air getting up. then
we left it till four
oclock then we tried

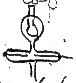


it and it was about
one inch and a half
from the top tested it
again at six oclock
and it went down
about threequarters of an
inch.

~~Lathe Halo~~

~~Had a pump made~~
~~them of~~.

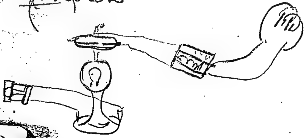
Had a lamp made in
the afternoon by Bohm which
was on top of a sparkgauge
like this



In the evening
we exhausted it, commencing
at eight and ending
at ~~ten~~. The lamp was
heated for about an hour

July 8 1880

had the induction coil
fixed up, two cell in
multiple arc, gave a
spark about two and
a half in in length.
then put it on the
lamp (or rather on the
spark coil above the
lamp) being fixed as
shown below



then I moved the two
points together of the induction
coil to see which was the
smallest resistance the
gauge or the air, the
gauge seemed to be it, show-
ing that the vacuum was
not so very good, because
it allowed the current to
pass through it, it gave
that blue (~~lig~~ sky blue)
phosphorescence on the
outside end of the induction
coil, and on the other
end it was very slight
~~green~~ green (but at the
end)

~~Bast~~
Paper
Palm Leaf
Rice Straw
Bamboo

7/1000

July 8 1880

(Test at the armature that was crossed the day before yesterday with the wire that is ~~[illegible]~~ wound on around it. It tested all right, [illegible] Remainder being the res.)

Got another pump put up at about half past eleven and put a gauge on to it, and at twelve sealed it off: then put it on the spark coil; and showed a poor vacuum; (it must have had a crack in it)

Put a Bast fiber 6 in long, 12 by 12 5/64 on the end, put it on at 20 m past one o'clock about three after they were through using the Railroad I put the current on, it had a bad spot on it near the clamps,

3 | 64
32

32

6290
6280
12570
3 7770
12
2 wat | 497.00
2

Test of Lamp

Bass fiber 6 in long

Res cold Δ 310

20 cells = 32 Df.

C. ~~17~~22

E. M. F. 217.

Def on Lamp ~~[illegible]~~ 70

Def on Res 70.2 ohm ~~170~~ 18~~4~~

16C

Def on Lamp 65 . 175

Def on R 175

Em F. 206

3) 206 (2b
.682
23
136

70.2

175 : 65 :: x : 70.2 1370

175
70.2
350
1325

65

Res 204R 65) 13125.510 (204R
130
0255
260

137 4
137

137 4
137
959 2
411
137
18769 22 2
4413
56307 3
75076
75076
831466.7

204) 831466.4 (4
2886

Res.
210
204) 831666 (4076.
816
1506
1428
1386
1224

4076.
.8
32608
33000

8
8

4076
204
16304 2
152
304

4076
204 2
16304
152
831504

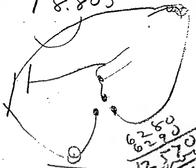
184 : 70 : x : 70.2

184 2
70.2
368 5
1288
70) 12916.8 (184.5
598

70
316

6290
6330
12620
2285
18805

1600
500
400
200
100



8 | 31 00
16 2
16

700
500
600
3100
32
6300

62890
62890
12570
1757 0

Put on at K12 at 44 C. Def 242 - 162

70 | 14000
200

14000
12620
1380

17570
175.

12620
1400
2 | 24020
7010

10000
46000

Lamp exhausted
2300
until night. while heating & there seemed
to be a little blue.
Res while cold 2320 ohms
when at 16 C. it was 1470 ohms
Def on Ell 7. 3/180

20 cell = 32

14
341

120
12
2400

60
120 v
10000

14
624

120
120

120
120
2400
1440
14400
463

10000
1580
1323
157

147
588

43200
57600
57600

1323/147) 6879200 (43
588
499
441
1580

105

14000
12620
1380

6280
6290
6250
6250

6280
6290
6250
6250
9000
900

25070
4400
29470

27) 34970 (174

2947 (147

147) 637920 (4339

was put on at 11.20
at 44 C stop at twelve
was put again at 44 C
at 8.57 went up at
nine oclock.

July 90 1880

Large Carbon
Lamp 12H [illegible], Lead Glass,
commenced at 9,40
[illegible] Twelve
[illegible]
[illegible]

Tested Carbon [illegible] Cold
it was 275 ohms.

6

6290
6280
6260
6250
6290
3500

207) 34879 (174
145
140
8621
69

212
207
419
209

3 | 207
69

1½

Cold 275 ohms
when hot at 16 C
it was 174 ohms.

Ein 7. 207 - ~~212~~

1380

138
138
1104
414
138
19044
4410
7132
76176
76176

174) 843649.2 (4848. ft lbs
696
1476
1392
844
696
1489
1396
93

4848 | 33000 C

put at 41°C at 8 o'clock
it was slightly blue
with pinky, went up
at 3.05

7010

[illegible]

~~27~~

200 [illegible] 6290

2 | 14020
~~27~~) 7010 (7

[illegible]

Bamboo 1248

was put on at 3.20
and at six took it off.
after supper I wanted
to test it and I ~~saw~~
it was broken at the
clamps.

July 10 1880

No. 1249 ~~Palmetto fiber~~

had it exhausted the morning. Res when cold 483 ohms,

152 U²
152
304
760
152
23104
44.3
69312
92416
92416

300) 1023507.2 (~~3411~~ 3411 ft lbs

3411) 33000 (9.6 per
30699
2301

horse

~~No. 1253. Bamboo of the Tip of a Cane~~

At 17 C. E.M.F. 227-220

Def on Res. 253 Res. 70.2

Def on Lamp 59 300 hot

253 : 59 :: x : 70.2

253
70.2
506
1771

59) 17760.6 (300.
177
60

3/227
75

3/227
76
2
152

2/2?
76

No 1253 Bamboo from
the top of a far...

20 ft 65

Res when Coil 188 R

17 C . E.M 7.298

8.6

3

99) 434184. (43
396
381

114) 434184. (3808
342
921
912
0984
912
72

3

3

1

6290
6280
6260
4100

200) 22938 (114 hot
200
29
20
93
80

3) 298
99

99
99
891
891
9801
443
29403
39204
39204

$\frac{v^2 \times 44.3}{R}$

3808 99
3046479

99) 434184.3 (433
396
381
297

38081) 33000 (8.648
30464
25360
792
564

1259. Paper

busted on the pump, there was a very bad of [illegible] one of the clamps.

Sunday July 11 1880

Went and made the dey of my twenty cells = 216 dey and then left it, to renew them again

---

When renewed it gave 241-244.

10/240 (24) O

July 12 1880

Another test of Bamboo Lamp. No. 1253 burning at 160 c/9

3 .. 7 . 2 ... 3 ...

3 lbs.

289
310
2|599
2|299
99

6290

22630 (113
20 4
26
63

113.) 434184 (384 2 ... lbs
339
951
904
478
452
264
226

... 842) 30 ... (8.5

22640
210

put on at 10.10 a.m. at 44 C. .. 315 d.

after being ~~...~~ burning 30 m I took off the C to Reid the lamp on the pump. put on again at 44 C at 10.48 stop again at 11.28. put it on again at 11.30 it broke at 11.35

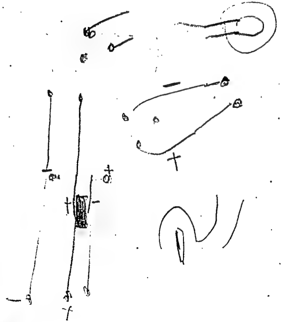
30 m
45
75

12
28
5
45

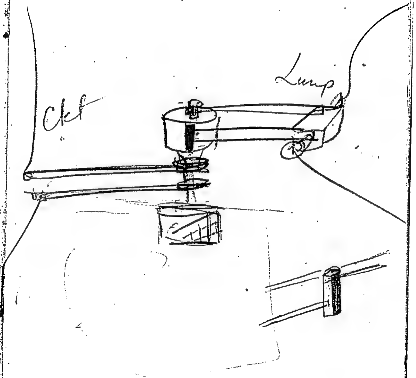
have burned a total of 75 m at 44 C.

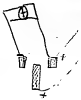
July 12 1880

1250 Palmetto ;
very bad spot look and
scaled it off.



Corning glass, lamps with
spark gauge, No 1251





$$\mathcal{E} = \frac{Q}{R}$$

$$R = C\mathcal{E}$$

$$\cancel{\mathcal{E} = \frac{e}{R}}$$

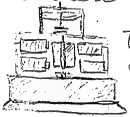
$$e = \frac{\mathcal{E}}{R}$$

$$eR = \mathcal{E}$$

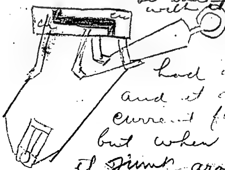
$$R = \frac{\mathcal{E}}{e}$$

Dec 17 [illegible]

Took a little [illegible] (electric motor) the three armature one with four [illegible] two on one side and ~~the~~ two on the other, something as shown in the figure



Then made an armature so that the current could be reversed, something as show in the figure below. And had it on the motor so that it would revolve with it.



had a lamp on and it allowed the current first straight, but when the lamp busted it jumps across the armature and burned it a little

1237

Brass clamped very slight

$$\begin{array}{r} 273 \\ 1.3 \\ \hline 819 \\ 273 \\ \hline 49 \end{array} \qquad \begin{array}{r} 273 \\ 1.366 \\ \hline 1638 \\ 1638 \\ 819 \\ 273 \end{array}$$

$$373)\overline{372.918}(1$$

$$V = \frac{273 \times v}{273 + t}$$

$$V = \frac{273 v}{273 + t}$$

$$v = \frac{273 \times v}{273 + t}$$

$$V = \frac{Rv}{760} \quad 380 \quad \frac{380}{760}$$

$\frac{20}{60}$ 60

$$2000 \quad 2 \quad 8000$$

$$14$$

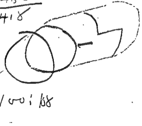
100 : 108 :: 60 : x

1080

100)10450

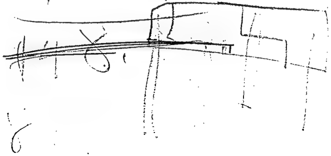
6418

6 2 9 2



1988

100 : 108



St Francis Bea...

Francis Peauce

A. Francois Beau...

Forerunner Franklin

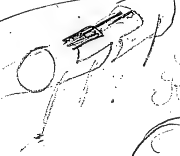
Boston Review

Fortnightly

Review

Review

Review



July 26 1880

Lamp that was put in Kerosene
Lamp put up at 9.37
at 120 C and tested at
10.1
~~8~~ ohms when hot at
this candle power

$$\frac{254}{250}$$

$2)\overline{504}$

$20)\overline{252}(12.5$

1,08   64

$4)\overline{254}$ 63

$4)\overline{252}$ 63

100 : 1.08 :: 64 : X

$$\begin{array}{r} 108 \\ 64 \\ \hline 432 \\ 648 \\ \hline 100)\,6912 \\ 69.12 \end{array}$$

Testing Standard cells. Aug 18 1880

Cells	R	L
Box 1	254 Def	250.5 Def
2	254	250
3	251 / 253	247 / 250
4	244 / 254	240 / 250
5	253	248 / 250

~~1.08 :: 100 :: X : 83~~

~~100 : 1.08 : 3 :~~

$$\begin{array}{r} 108 \\ 3 \\ \hline 324 \\ 3.24 \end{array}$$

100 : 108 :

Aug 18

Testing that small piece of Railroad track.

Res of Wire 3.85. ~~ohms = 3.85~~

Res of the track 4250 ohms

Tested it with B dyc and with Thompson Quad Res Gal.

Testing the 25 wire cable

Tested 13.9 ohms there

Must be a cross somewhere

3)130 (10

43

2

86

33)1330 (4.

2

21.6

3 61

Aug 19 188

10.2/3 3) 6

1/2 70) 14000
2000

10.2/3
32

50) 200

21.6
4
86.4

3) 42
.16

420

64) 270.0 (4.2
256
140
128

21.6
4.2
432
864
90.72

1200
14000
12600
1400

12600
1400

70) 14000
14000

70) 14000 (200

Aug. 19 1880

Lamp No 1453

8 x 16

Res. Cold 329 ohms

10.2/3 C

Em R.208 L.208

37.660 Res.
5000
200

143 / 6.0
215 ohms

Em R 243 L. 239

32 C

20 cell 32 R
" " " 33 Y
2) 65
33

37.660
100
200

Aug 19

33)2080(6.3
198
100

21.6
6.3
648
1296
136.08

136.V

10.66 C

10.66 C 136 V
136
816
408
136
18496
443
55488
73984
73984

ohms 211)819372.8(3883. ft lbs
633
1863
1688
1757
1688
692
633

37660
200)43160(210. ohms
400
316
160

10.66
8.4
4264
8528
89544 C per H.P.

3883)33000.0(8.4 P.H
31064
19360

10.66 C
Res 210 ohms
ft lbs 3883,
per H.P 8.4

243
239
2482
33)241(7.3
231
100

21.6 all
7.3
648
1512
157.68

157 V
157
157
1099
785
157
24649
443
73947
98596
98596
188)651950.7(3467 ohms
564
879
752
1275
1128
1470
1316
154

37.660
200)37760(188 Rs
200
1776
1600
1760

32 C

3467)33000 (

3467
7
24269

157
157
1099
785
157
24649
443
73947
98596
98596

188)1091950 (5808. ft lbs
940
1519
1504
1550
1504
46

5808)330000 (5.6 ~~ft lb~~ P.
29040
39600
34848
4752

188 × 7 = 1316

x

$\frac{x-10}{10} =$

$\frac{x}{4} - 10 = \frac{x-10}{10}$

~~$x = 40$~~

$10x - 400 = 4x - 40$

$6x = 360$

$x = 60$

5808 × 5 = 29040

$\frac{x-20}{12}$

$\frac{x-20}{12} = \frac{x}{6} - 20$

$x - 20 = 2x + 40$

32

5808 ft lbs
Res 188 ohms
5.6 Per H. P.

16
8
128

144 : : 165
165
720
864
144

128)23760 (184 ohms
128
1096
1024
720

223)1000 (

ans 19 meter 45 Res

no	.107 has	R 45
1	.11 –	£ 43
2	.02	R 40
	.03	£ 182
3	.0219	R 48
	.03	£ 179
4	.02	R 55
	.03	£ 168
5	.0284	R 85
	.03	£ 150

235)1000 (.4

85
.4
34.0

Aug 20 1880 58.2

Meter Res.

No 1 Res .106

R 45
L 43
88

45
88)1500(1.4
88
220
180
40

4.5
1.4
180
45
63.0

Diameter
.017
.011
.011
.011
.011

No of Band	Res	Di	Lgth mm	Meter Shunts German Silver
1	~~.0106~~ .106	.011	583 mm	6 mm
2	.0216	.011	437 mm	25 mm
3	.0219	.011	436 mm	25.5 mm
4	.0222	.011	608 mm	35 mm
5	.0234	.010	610 mm	35 mm

~~No 1 Res .106 Di .011 Length 583 mm~~
~~2 .0216 .11 " 437~~
~~3 .0219 .11 " 436 "~~
~~4 .0222 .11 " 608~~
~~5 " .0234 .10 " 610 mm~~

125
125
625
250
125
15625
443
46875
62500
62500
195 | 6921875 (3549. ft
1385
9 75
968
780
1887
1755
132

3549 | 33000 (9.0
31941
1059

3549
941

3549
8
941

Aug 20 188

1457. 8+16 (from George)

Cold 307 ohms

10.66 C

E M 7,197 8
190 R.

R 37,650
1.500
200

195 ohms

37,650
1.500
200 | 39159 (195
1915
1800
1110
1000

31
36
2 | 67
33

1250

197
190
2 | 387
33 | 183 (5.8
165
280
264
16

216
58
1728
1080
12528

Res Cold 307
10.66 C
Res 195 ohms
1250
ft lbs 3549
9. H.P

110 110/110 0

110/110 000

160/110 12100

110/110 1100 12100 443

26300 48400 48400

159) 435030.0 (2736.

318

1170

1113

477

900 654

2736) 33000 (12.1

5640

159

11

159

Cold Res 262
Hot 159 ohms
1100
2736 ohms
12 1.9

Aug 20 1880

Lamp. 1452

(note from Batch book) Bamboo carbon
Ocean Electric in the old Lantern, marked
8/1000 by 16/1000 Aug 18 1880.
germaine glass, edge ways

~~10.66 candles~~

Cold 262 ohms

E.M.F. L. 173
R. 16.6

173 + 166 = 339

33) 164 (5.1
165
40

Res

~~6290~~

37650 − 6210 = 31360

37.650 − 6290 + 500

200

31360 + 500

200) 31860 (159
118
1800

Batteries 1.59 ohms
R 31
L 36
67

33

1100
21.6
5.1
216
1080
110.16

339 7.5202
67 8.1739
21.6 1.3345
2.0386

109.3 Volts 2.0386
1.6464
159 7.7986
3.5222

3300

10 per H.P.

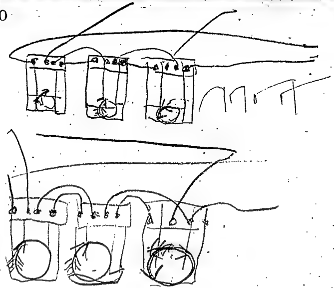
Aug 21 1880

Tested some of the cables
Found one was [illegible] 25 and 15 [illegible]
[illegible] Tested
at dead [illegible]
to the lamp post dead cross
after [illegible]
[illegible] 2145 ohms [illegible] 1085
This cable [illegible]
with muslin [illegible], covering
with muslin covered with [illegible]
coal tar ~~bo~~[illegible] with crude [illegible]
[illegible]

Aug 23 1880

Carmans Circuit 25. 18. 11
and Turnpike section in all other
[illegible] between wires 15 ohms

Ground 37 ohms both sides



Aug 28

Fixed up the machines in the dynamo room, three tables in series.

Also made some testing batteries, jars & carbons.

Aug 25 1875

The machines operated very bad last night (aug 24) In the morning I tested all the lines, & found that the cross was in the Locomotive line Res between the wires cut was 2.4 ohms

Aug 26 1880

(hard shower yesterday) Armours circuit 25 & 18 wire section circuit between wires 3,000 ohms ground 1250 & 1435 ohms

aug 26 25.18.11 & Turnpike section in circuit.
Between wires 13.6 ohms
Ground 37.4 & 37.5

Aug 26 1880

Lamps with nickel clamp

12 by 12.

1463. 1464. 1465

Battery $\frac{31}{2} = 31.5$

$$\begin{array}{r} 21.6 \\ 8.4 \\ \hline 864 \\ 1728 \\ \hline 181.44 \end{array}$$

$31.5\,)\,2656\,(\,8$
2520
7300
.260

1805.

No 1463. Aug 26 188

Put this on Photometer

at 50 candles one clamp shows a blue flame inside the loop as if it were caused by joint of Platinum and nickel also that clamp blackened ~~slightly~~

at 30 candles same only weaker

at 16 candles it did not show it

Other clamp clean and bright.

E. H. J. Del 260

Aug 26 188

Lamp 1464 =

On Photometer

at 48 candles showed a little blue on same clamp filling only space × like 1463.

at 18 candles it showed more and on outside of clamp also - put on at 48 candles again and it showed blue very strong —

Lamp 1464

On Photometer

at ~~48~~ 7 candles showed no blue

at 21 candles showed blue outside and inside clamp

at 48 very strong blue

All the lamps were put on at 48 at 2.55. 1464 Lamp broke at 4.10

Aug 26 1880

31
32
2)63
31

Lamp No with nickel clamp
12 by 12.

No 1463. 1464. 1465 —

$$\begin{array}{r} 21.6 \\ 8.4 \\ \hline 864 \\ 1728 \\ \hline 181.44 \end{array}$$

Battery $\frac{31}{2}$ = 31.5

Res 2.60

31.5 (2650 (8.4
2520
1300
1260

180 V.

No 1463. Aug 26 188

Put this on Photometer
at 50 candles one clamp shews a blue flame inside its loop as if it were caused by joint of Platinum and nickel also that clamp blackened ~~slightly~~
at 30 candles same only weaker
at 16 candles it did not show it
Other clamp clean and bright.
E.M.F. Bat 260

Aug 26 188

Lamp 1464 =

On Photometer
at 48 candles showed a little blue on same clamp filling only space x like 1463.

at 18 candles it showed more and on outside of clamp also
put on at 48 candles again and it showed blue very strong —

Lamp 1464
On Photometer
At ~~48~~ 7 candles showed no blue
at 21 candles showed blue outside and inside clamp
at 48 very strong blue
All the lamps were put on at 48 at 12.55. 1464 Lamp broke at 4.10

Aug. 26 1880

Set of Standard battery. $CuSO_4$ + Zn

Box 1	L. 236.5	,	R 239
" 2	L 235.	,	R 237.5
" 3	L 237	,	R 239
" 4	L 238	,	R 237
" 5	L 237	,	R 239

Aug [illegible]

[illegible]

150) 245 (1. 242

169) 303 (2

284
281
2 | 565
282

300

1.2

21.6
1.8
1728
216
38.88

150) 282 (1
150
1320

Comparing Bi-Chromate battery (a small Fuller) with the standard battery

Standard cells	R Df	L Df	Fuller cells	R Df	L Df
1	169	168.5	1	319.5	322.5
4	87	88	4	163	164
4	169	158	4	297.5	294
~~4~~			4 [illegible]	303	300
					300
20	150	150	20C	284	281

284
[illegible]1
3 [illegible] 3.65
1.88
1.04

1.88
1.08
1504
188
2.020 4

21.6
1.08
1728
216
2

21.6
1.8
1728
216

21.6
1.8
17.28
216
38.88

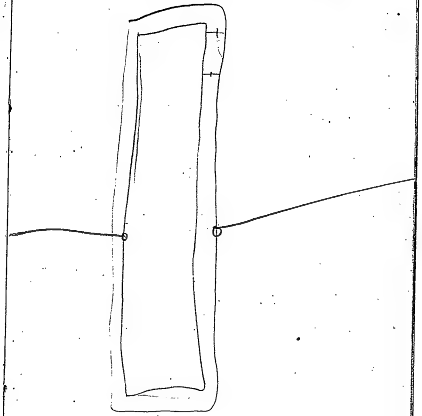
Aug 27 1880
Small [illegible] R.R.
~~[illegible]~~
Res. 8390 ohms

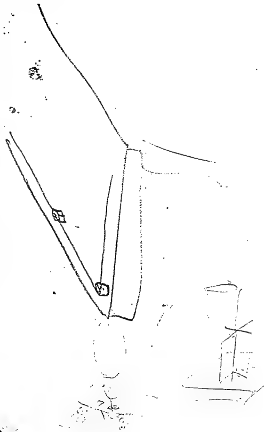
Aug 27 1880
Gum Benzuela
Oil spruce
oxalic Acid

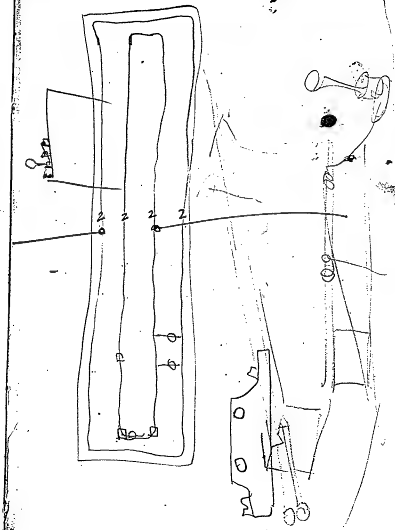
Tungstate ammonia
Gum Benzuela
Oil Spruce
~~[illegible]~~

Gum amber
Benzuela Copal
Anilin Oil
oil succin
Carbolic acid
creosote.

Benzuella Copal
Gum Camphor
oil sprue






2 2 2 2

Aug 28 1880

Ex 1.
Put a lamp in the bridge and balanced it, then jarred it to see if it would alter its Resistance, but the gal did not move also tried a little heat water a lamp but did not ... , had five cells

Aug 29 1880

The last one made of the spiders showed a poor vacuum the spark did not jump outside There was a light pink phosphorescence and the glass ~~had~~ a green phosphorescence

2 one of the spiders made some time ago its phosphorescence was much brighter, showed a poorer vacuum than the one above

No 3 showed a poor vacuum

Test of cable made by Howell. was put in water and tested 54 ohms

another coiled wire without insulation ~~tested~~ 127 ohm

2 R

Insulated cable I lifted the Fe plate up and it went up to 180 ohms.

Aug 31 1880

Test the bare wire by R Mellott:

$R'' = 1001$
$R = 1000$
D of 226 + R'' + R
S = 100 ohm

Cable Insulated

R'' 500
R 500
Def of 352 with R'' & R
S 120

~~225~~
~~300~~ 339 Def

77 ohm plate down

September 1 1880

Cable 3 layers Tar ~~Rubber Cloth~~

Aug 31 1880 51000

Sept 1 " 4850
Sept 2 3200

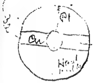
Sept 2 1880

~~Made a~~
~~Got a thin piece of Rubber & cut a hole in the center. ...~~

2-8 2
7230

September 2 1880

Made an apparatus as follows, to see if any thermo current [illegible] mixed up.



[illegible] a [illegible] solution [illegible]

[illegible] a [illegible]

[illegible] a [illegible]

[illegible] [illegible] 40, and then [illegible] fell

I then concentrated light [illegible] the small piece [illegible] had the [illegible] there [illegible]

no difference, the spot of light went gradually [illegible] before, [illegible]

[illegible] with two Daniell cell [illegible] a deflection about 45°.

Sept 2 1880

Cable no 4 3 thick [illegible]

Each [illegible] with [illegible]

cone [illegible]. Res 120 ohms.

2 m.m. 20 [illegible] September

Sept 2 1880

Some of Phillips cotton insulated parafin wire. Insulation Resistance 36,000 ohms.

69)366 80(52.40

3810
34.5

345)3844.5(111.4

111.4
34.5
5570
4456
3342
384 3.30

111.4
352
2228
5570
3342
392 12.8

528)39212.8(74.2

3810 + 34.5 / 34.5

3810 + 6900 / 6900

524
69
4716
3144
36156

3810
74

Kent Test | Sept 3 1880

Res of H.R.G. 3810 ohms

Con {Def on 1 cell on Condenser without Shunt 69 – 69

Gal {Def on Gal of 1 cell. ~~Rev~~ 351 – 355
Res of Shunt 6.900 ohm

{Def on 40 cells. 350 – 355
Res on Shunt. 34.5

Con {Def on 40 = 69. ~~69~~ 71
Res of Shunt = 74 ohms

1 cell + 10000 ohms. Def 351 – 355
Res of Shunt 427. ohm

Kent wire Def with 40 cells 50. 50

Insulation 5032040 .

No. 2
September 3 1880

3 layers of Rubber each & 3 Caifs [illegible] Tar. 3200. ohms

Sep 4 2630 ohms
6 1500
8 2400

2 thick muslin each covered with hot linseed oil

Sept 3 470 ohms.
Sep 4 140 ohms
Sept 6 110 ohms

" muslin wound on cable
then served with parrafin
then rubber cloth, then
cloth again with parrafin "

Sept 3 1200 ohms

Sept 4 171 ohms

Sep 6 120 ohms.

3 thick muslin each
served with coal tar
~~treated with ozokerite~~ "

Sept 4 120 ohms.

Cable no 8 Sept 4

167
Three thickness rubber
17 470 cloth with rubber
470 cement between
1st and 2d + 2d + 3d
layers.

Sep 4 Res when first put in 12500
th about a half an hour
afterward it went down
to 7000. (the water having
soaked in by this time a
little) 130 ~~134~~ ohms

Sep 6

Cable no 9 Sept 4

3 thick rubber cloth,
with parrafine between
1st + 2d and between
2d + 3d layers.

Sept 4 9000 when first put in
the water, about a hour
afterwards it was reduced
to 3500

Sept 6 120 ohms

Sept. 4

Res of one (first) Faller cell
2.12 ohms

~~Phillipp~~

Phillips went down
from 36000 on Sept
2 to about 250 on
Sept 4 1880

Sept 6 1880

Carbons for Rowland

No 1 Paper with 2 volts. on for
10 minutes in a diluted
solution of C.P. $CuSO_4$

Sept 7 1880

Galvanometer wire 15.5 ohms

Long Carbon 9.40 on 8.U
took it out at 10. was plated
all over.

No 19 Sept 7

Sept 7

79.000 ohms.

No 10 Sept 7 ~~1880~~

Sept 7	2 990 00 Ohms
Sept 8	1400 . ohms

Cable No 12

Sept 7	26000.
Sept 8	1000 ohms

one length of 100 ft of bare wire
submerged in water.

~~Res~~ Date	Res	Date						
	127.							

Cable No 1

One Thickness Rubber cloth (white)
spiraled overlapping about 1/3
and tarred with stiff coal tar,

Res. 54 ohms. plates lower down
in the water

Cable No 2.
3 layers of Rubber cloth and
3 layers of tar.

~~Sept~~ aug	Res	Sept	
31	57000	11	2400
Sept 1	4850	~~Sept~~ 13	1910
2	3200	14	2000
4.	2480	15	2000
6	1500	16	1800
8	2400		
9	2400		

(No 3) Two Thickness of white rubber cloth
wound in opposite directions
Res 77 ohms.

 No 4

3 thickness of cloth
Faced with boiled coal
tar. Res 120 ohms
Sept 200 Sept 10 200 ohms
taken out

No 5 Two thickness cloth each
served with hot linseed
oil. Res Taken out

Sept	Res	
3.	470	
4.	140	
6	110	
9	170.	
10	170	

No 6 Cloth wound on Cable
served with parrafin, Then
Rubber cloth (Black)
Cloth again with parrafin

Sept	ohms
3	1200k
4	171
6	120
9	140
10	130

taken out

7 3 Thickness cloth, served with coal tar, treated with quicklime

Sept 4 120 ohms taken out

8. Bare wire rubbed with dry hard parrafin
Thin Rubber cloth Blk covered with ~~bl~~ black rubber cement
Then rubber cloth, then cement.
Then rubber cloth, scrubbed down with hard paper.

4 Sept	12500	Then went down to
	7000	Sept 10 209
		Sept 17 210.
Sept 6	130	
" 9	210	

9 Bare wire rubbed with parrafin,
Rubber cloth
Then cold & hot parrafin
Then rubber cloth and parrafin
and rubber cloth with more
parrafin (cold)

Sept 4 9000 ~~wht~~ went down ~~to~~
~~the two~~ after being in the water
for an hour 3000

" 6 120 ohms.
" 9 120 ohms.
10 120 ohms

Took the cable No 10 and had the ~~the~~ coils lifted up and measured it overtime.

Cable. Sept 11.

1	320	ohms
1	324	" "
2	390	" "
3	500	" "
4	550	" "
5	550	" "
6	580	" "
7	580	" "
8	540	" "
9	540	" "
10	544	" "
11	570	" "
12	570	" "
	630	" "
	750	" "
	970	" "
	" "	" "
	1000	
	1200	" "
	1400	
	1500	

10 Rubber cement on bare wire thin Rubber cloth, muslin, Compound 3#, rubber cloth rubber cement, rubber cloth Rubber cement, ~~rubber cloth~~ ~~Rubber cement~~ dusted with Chalk.

Sept 7	299000
" 8	1400
" 9	500
10	450

No 11 Rubber cement on bare wire /1 thick
Rubber cloth
muslin
compound #1
Rubber cloth
" cement
cloth
cement
Dusted with chalk

Sept 7	79000
" 9	240 ohms
10	215 ohms

$$cX + cr + cy = c_1 p + c_1 r + c_1 g$$

$$cX = \frac{-cr + cy + c_1 p + c_1 r + c_1 g}{c}$$

$$c(R + r + y) = c_1(p + r + y)$$

$$y = \frac{c_1(\quad)}{c}$$

$$R = \frac{a_1^0}{a^0}(p + y) - y$$

$$R = \frac{a_1^0 \, a_1^0 p - a_1^0 y}{a^0} - y$$

$$a^0 R = a_1^0 p + a_1^0 y - a^0 y$$

$$a_1^0 y + a_1^0 + y = \frac{-a^0 R + a_1^0 p}{a_1^0 + a^0} = a$$

100000 $\quad$ 10000 / 1000

12 Marlin on bare wire
Compound #2
Muslin soaked in linseed
Compound 2 # thinned with Cotton
seed oil Muslin
Rubber cloth
" " cement
Rubber cloth "

Sep 7,	26000	
" 8,	1000	ohm
" 9,	740	ohms
" 10	540	"
" 13	300	

No 13. 5 - 6

20 5 wire covered with Marlin
Then boiled in compound
#3 Then Rubber Cloth

14 7 strands wound with
marlin.

15 Muslin
Refuse Compound
Muslin
Refuse Compound

Sept 13 Res 140 ohms

16 White rubber cloth 3 layers
Boiled pine tar 2 servings
Made to compare with #2

Sep 13
176000 ohms

85000

Sept 14 85000 ohms
" 15 30000 ohms
" 16 12500 ohms

17

18

19

Rubber cloth
Compound # 7
Rubber cloth
Compound 7
Rubber cloth

Compound 7
Oxized. linseed oil Pine tar
+ asphaltum
+ paraffine

Sept 10 1880

B $32 - 32$ .55 [illegible] $1.2 = 3/183$

60

2

machine 11

B. $32 - 31.5$ $89.0 = 80$

B $= 64$ $63.5 = 179$ # 179.

Machine 10

B $64 - 62.5$ $176 = 177$ 59

Machine 4

B $64 - 64$ $163 - 160$ 5.4

55 120.5

4
10
11

32) 182 (5.6
160
2.20
1.92

21.6
5.6
1296
1080
120.96

21.6
2.8
1728
216
35.88

64) 179 (2.8
128
512

$\frac{v^2}{R} = 44.3$

Machine No. 4 heated

more than [illegible]

Marked thin

6 1/4 X 9

The resistance of armature .14

Magnet 1.7 Ohms

Line all right

[illegible]

[illegible] magnet

Magnets

55 [illegible] ~~B = 24 000~~

B = 24000 [illegible] B [illegible] .424

1	.14
2	.15
3	.14
4	14
5	14
6	14
7	14
8	.19
9	14
10	14
11	14
12	14
13	14
14	14
15	14
16	14
17	14
18	14
19	14
20	14
21	14
22	14
[illegible]	14
24	14
25	14
[illegible]	17
[illegible]	14
28	36
[illegible]	14
30	14
[illegible]	14
[illegible]	14
[illegible]	14
34	[illegible]
[illegible]	14
[illegible]7	14
[illegible]8	14

Leading wire .06

.042) 9.83 (234.4

2344.

9.83

.042
.042
84
168
.001764

.140
.040

50) 800 (.160
500 800

.042
.042
84
168
.001764

546111.
4368888
546111
9829998

9.83

.0018) 9.83 (5461.

5461.
.0018
43688
5461
982998

Sept 16 1880

testing The per cent of cu in The wire. for The armature

Length 30 ft Temp. 77° Fr

Diameter .042

.0415
.041
.0415
.041
.042
.0415
.0415
.042

Res. .185 ohms.

Length 30 ft Temp 77° Fr

Weight in grams 108.6 grams f 3 feet

108.60
1086.0 1086 in 30 ft

.0018) 9.83 (

.003824
19120
7648

5461.
30
163830
1474470
17857470

$4/9.83$

$1764)9.8300(.0057$

$.0179850$

$.01798.50 : .185 : 400$

$.18/.0$

$2.367)\ 2.2065\ (.96$

$1764)\ 2.21441\ (.18$

$.185)\ 18.00\ (.97$

$\frac{18}{100}\ \frac{18.5}{100} = \frac{18}{100}\ \frac{100}{18.5})\ 1800$

$\frac{1}{3}/108.6\ \ .18$

36.2

36.2 grains in one foot.

$30)\ .180\ (.006$

1 foot Res .006 weight 36.2

$.2367)\ .21850\ (.9$

$.2367)\ .21060\ (.9$

Lesson No 19 cable

Def in one cell $\overset{L}{\cancel{300}}$. Res of S 1260
R 305

302

302
4.09
2718
1208
123518

1260) 5168 (4.09
5049
1200
1124

3944.4

44.4) 3944.4 (88.
3552
3924

444
3996

2416
2416
26576

15518) 26567 (17.
15518
110490
108626
18640

15518
9662
15518
124144

15518
108626

15518
17
108626
15518
263806

302
27
2114
604
8154

12351) 26567 (21.1
24702
1867
1235
2320

26567 (17
217

148) 4048 (27
2960
1088
1036

148) 4048 (2
60

Def one cell L300 R305 Res of S 1260 ohms
" 20 " L300 R305 Res of S 444 ohms
(Def of one cell through 10000 ohms L300 R.305
(Res of S 148 ohms.

Def in cable 300 . 307 Def
Res shunt 1030

S 974 300:307
S = 940 Gal R 3900

~~123518~~ Def of one cell without S
26567. " " " " " " " "

21.1 times

8154 through Gal with its S
21.1
8154
8154
16308
172049.4000
10000
172044000

Res 1117.138. ohms

3900
950
950) 4850 (5.1
485
475
100

302
511
15302
1510
15402

1540) 172049400 (111.7138
154
180
154
264
154
1109
924
185

1109
1078
214
154
600
462
1380
1232
1480

4 = 4 2 3
1232 4

202.5
203
~~4~~
135

251.50
40
2915
1457   160

2.1303
2.1303
1.6064
7.8356
3.7426   5530

Oct 6 1878

Res	~~31400 +~~ no 91
EM7	202.5 − 203
Res	$\frac{25150 + 4000}{200}$
e	48
But	32 − 32
EM7	168 −
Res	$\frac{25150 + 5900}{200}$
e	16

237
236
473
158

376.5
5
381
190

2.1987
2.1987
1.6464
1.7212
3.7650

5820

216
433
144

37650
500
20)38150 (190 ohm
180

4 m 7	237 – 236 no 98
c	48
Res	$\frac{37650 + 500}{200}$
	Blue at one of the clamp
8 m 7	217 – 216
Res	$\frac{37650 + 2400}{200}$
c	16

37650
500
20)48150 (240
40
180

215 $\frac{5}{2}$

$3\overline{)430}$

143

Emt	215 – 215 no 36
Res	$\frac{31400 + 5000}{200}$
e	4
Emt	180 – 182
Res	$\frac{31400 + 7000}{2000}$
Res	16

31400 143 √
5000

200) 25400 (182 R
204
168
2

E M7	244 - 244	No 17
Res	$\frac{37650 + 2800}{200}$	
C	4 8	Blue at the Clamp
E. M7	209 - 209	
Res	$\frac{37650 + 5600}{200}$	
C	16	

37650
2800
20/40450 (2022R
1620

244
3(488
162

Em7	225 – 220 no 43
Ris	$\frac{31400 + 4300}{200}$
C	48 Blue at clamp + [illegible]
E.M7	195 + 197
Res	$\frac{31400 + 6400}{20}$
C	

31400 1500
43000
20) 357,0,0 (178 R
20
157
140
170 225
3) 450
150

E.M.T 204 − 203 no 47

Pos $\dfrac{31400 + 1800}{2000}$

C 46

E.M.T 173 − 172

Pos $\dfrac{31400 + 3500}{2000}$

C 16

204
203
2)407
135

31400
1800
20)3320.0 1355
166 R
132
120
128

EMF 194 - 194   40

Res $\dfrac{25150 + 6100}{200}$

R 48

EMF 164 - 163

Res $\dfrac{25150 + 7800}{200}$

R 16

25150
6100

20) 31250 (1290
20
113
125

(156 R

194
3/388
129

240 212

110 675

E.M.F	240 – 241 No 45
Rco	$\frac{37650 + 5300}{200}$
C	4
E.M.F	212 – 212
Ris	$\frac{37650 + 7900}{200}$
C	16

37650
5300
20)42950 (214 R
1605

241
240
2)481
16

EMT	211 - 211	Mol
Rs	$\frac{31400 + 400}{200}$	
e	48	
EMT		
Rs	$\frac{31400 + 5600}{200}$	
e	16	

31400 1400
400

20)31840 159 R.
20
118
100
180 3422
180 140

E.m.f	214 – 214	No 75
Rs	$\frac{31400 + 1400}{200}$	
C	48	
	Blue in clamp.	
E. m.f	190 – 190	
Rs	$\frac{3100 + 31400}{200}$	
C	16	

31400
1400
20) 32840 (1642
20
128
120
80

1428
164 R

3|428
142

E.M7	206 – 208	ho5
Res	$\frac{31400 + 1800}{200}$	
e	48	
E.M7	175 – 177	
Res	$\frac{31400 + 3700}{200}$	
e	16	

$$\begin{array}{r} 31400 \\ 1800 \\ \hline 2)\ 33200 \end{array} \quad (166\ R$$

1385

132
120
120

206
205
3)414
138

173
164
212
176
177
8)1400
186
230
1302
1116
125550

225
204
200
211
227
8)1723
215
675

E.M.F.	229 – 230	No 92
Res	$\frac{37650 + 1600}{200}$	
e	48 Blue at Clamps	
E.M.F.	196 – 198	
Res	$\frac{37650 + 4200}{200}$	
e	1.6	

37650
1600
20)39250
20
192
180
125

153 ✓
196 Res

229
230
3)459
153

12 25 20

25y

20y 6

5y

$$\frac{x-20}{12} = \frac{x}{6} - 20$$

20

$x - 20 = 2x - 40$

$+20$

$x - 2x$

$-x = 20$

25

20

x 25

$$\frac{x-20}{12} = \frac{x}{6} - 20$$

$x - 20 = 2x - 40$

$x - x = 20$

$$\frac{x-20}{12} =$$

$$\frac{x-15}{12} =$$

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

15
12
30
15
180

$x - 15 = 2x - 180$

180
15
165

$-x$

$$\frac{x-20}{12}$$

$$\frac{x}{12} =$$

$$\frac{x-20}{12} =$$

15
12
30
15
180

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

$x - 15 = 2x - 180$

180
15
165

$-x$

$$\frac{x-15}{12} = \frac{x}{6}$$

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

$$\frac{x-20}{12} = \cancel{x}$$

$$\frac{x-20}{12} = \frac{x}{6} - 20 - 5$$

$$x - 20 = 2x - 240 - 60$$

60
300

$$\frac{x-20}{12} = \frac{x}{6} - 25$$

$\cancel{2x}$

$$x - 20 = 2x$$

$$\frac{x-20}{12} = \frac{x}{6}$$

25
12
50
25
300

$$\frac{x-20}{12} = \frac{x}{6} - 15$$

$$x - 20 = 2x - 180$$

15
30

180

$$x - 20 = 2x - 10 - 180$$

$$x = 170$$

12+60 = x

5 10

$\frac{1}{5}$

2.

E M 7	212 – 212	No 90
Res	$\frac{31400 + 1400}{2000}$	
C	48 Blue at the Clamp	
E. M 7	185 – 185	
Res	$\frac{31400 + 33000}{3000}$	
C	16	

31400
14000
20) 32800
20
128
120
80
80

1415
164 R

424
141

EMT 232-235 2089

Res $\frac{37650 + 4100}{200}$

C 48

Blue at the Clamp

EMT 215-215

Res $\frac{37650 + 5700}{200}$

C 16

37650
4100
20)41750 (208 R
40
175

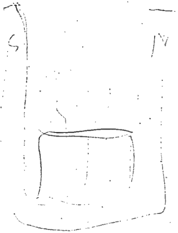
1550

233

232
235
467
155

E.m7	242 – 242	no 93
Res	$\frac{37650 + 5600}{200}$	
e	48 Blue at the clamps	
E.m7	215 – 218	no 93
Res	$\frac{37650 + 7600}{200}$	
C		

37650
5600 161
20)43250(216R
40
32
20
125 242
2)484
161



E.M7 229–229 no 88

Res $\frac{31400 + 5300}{200}$

C 48

Blue at the clamps

E.M7 203–203

Res $\frac{7500 + 31400}{200}$

C ± 16

31400
5300
20)36700 (183 R
20
167
160
70

1525

229
3)458
152

E.M.F.	225 − 223	No 87
Res	$\frac{3000 + 31400}{200}$	
C	·48	
	Blue at the clamp	
E.M.F.	195 − 197	
Res	$\frac{4900 + 31400}{200}$	
C	16	

$$\begin{array}{r} 31400 \\ 3000 \\ \hline 20\,)\,344.00 \end{array}$$

1490

172 R

$$\begin{array}{r} 225 \\ 223 \\ \hline 3\,)\,448 \\ 149 \end{array}$$

Em 7	232 - 235 2086
Res	$\frac{31400 + 6000}{200}$
C	48
	Blue at the clamp
Em 7	205 - 205
Res	$\frac{31400 + 8500}{200}$
C	16

31400
6000
20 | 37400 (155.5
(187R
174
222
235
= 467
105

Oct 9 1880

Test of some samples
of german Silver wire
for the resists coils down
the factory

at inches
9.6.25 of No .022 = 3 ohms
13 ft 1 inches of No .042 = 1 ohm.

No .015. 7 ft 4 in = 5 ohms

Oct 14 1888

1250

Oct 18 188

Plate $\frac{11}{2}$ marked = 1250 ohms

$\frac{11}{2}$ = 1480 " "

$\frac{1}{2}$ = 1250 = ohms

111 = 1250 "

11 = 12~~4~~0 "

1. = 1350. "

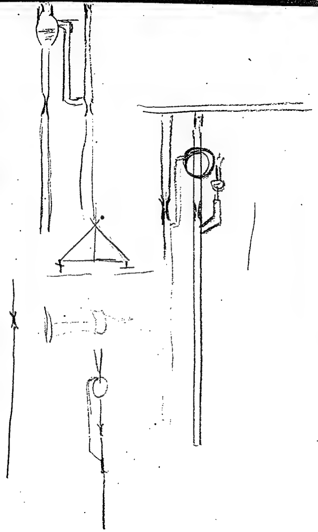
a. = 3000. "

afión

me ofició

Casimir Colina

5



Oct 19 1880

tried the experiment of washing oil the dry-carbonization

~~Volatilized~~ Find one

I took and tried was to bring the carbon up bright when I had the vapor of Chloroform I get a thick deposit of Carbon.

~~second~~. first

was a carbon tried in the vapor of the Bi-sulphide. this carbon was burning for about ten minutes in the vapor and then I took it out, Carbon seemed to be good.

Second Def. 215

This carbon was
in the saturated [illegible]
[illegible] [illegible] [illegible]
gave a good light.
and carbon when
taken out was good

Third. 210

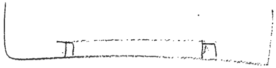
This carbon was burn-
ing on the [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
a good bright light.
I then took it out

Oct 20 1880

~~Took a Carriage~~
~~[illegible]~~

Generated some Ch[illegible]
[illegible]
a Carbon in [illegible]
put a current [illegible]
some crumbs [illegible]
formed in the Ch[illegible]
that [illegible]
which [illegible]
thick.

Oct 21 1880



Oct 21, 1880

Made an experiment by generating gas from (Gasoline) in a flask and then passing it in a mould in which there were some carbons. When finished, we found that they were covered [illegible]

Oct 22 188

Took a carbon bases and passed gasoline gas through the mould when it was a cherry red, when taken out they did not seemed to be covered. Then took some [illegible] coal and put them in when taken out a very fine [illegible] was found on them.

Oct 23 1880

tried some Carbons with Gasoline got it up to a very high heat. the deposit on it was a kind of woolly appearance.

Also tried some with [illegible] oil [illegible] [illegible] and got it up to a very high heat

~~Had some~~

Had some carbons also with paraffin in got this one up to a very high heat.

Oct 26 1880

Tried some naphthaline by boiling some of it in a flask heated on a sand bath in the [illegible] in which [illegible] the gas, ~~was it~~ [illegible] at the bottom [illegible] two pieces of carbon and then laid two carbons on top [illegible] and then covered [illegible] another piece [illegible] and heated it to a pretty good heat, nearly white! when taken out it had a silvery appearance the carbons had this thick [illegible]

Tried it again with naphthaline [illegible] used before [illegible] could not get good results.

We also tried [illegible] [illegible] [illegible] [illegible] [illegible] result,

40

6) 2000 1,480

13 3,20

7

43.2

86.4

1,480 7 4

13 3,20

7

.64) 133

128

5

40 = 64 Df. Dec 7/1880

40) 64 (1.6 = one cell

240

240

1.08

40

4320

$64^D = 43.2$

64) 43.0 (.675 = 1 D

384

460

448

.675) 33.000 (.197

43.2) 64.0 (1.48

43.2

2080

1728

1.48

Leading wires = 21. ohms
D.C. from machine without
malphets 16.5 X .675 = V

$$\begin{array}{r} .675 \\ \hline 825 \\ 1155 \\ 990 \\ \hline 11.1375 \end{array}$$ Volts

$\frac{\pi^2}{.28} \times 44.3$

12

$$\begin{array}{r} 1.1702617 \\ 0.9294189 \\ \hline 2.0996806 \end{array}$$

125.8

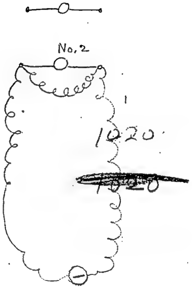
55,6 —

1.08   108
20   40

21.60 volts   43.20
2

43.20 Volts

64) 200. (3.1   43.
192
80



Dec 11 1880.

* 76 – 76 45° | 16

6279 Fuee 22
366
200) 6644 (33.90 84 1/3"
600
640
600
40

33 ohms

1.0880813.6
3.7616272

3.7616272
8.4814861
1.6464037
3.8895170

7753.

~~77~~
76
76

2 3
7729) 33000 (4.1 N
23916
10840

33) 25588.0 (7729.
231
240
231
098
66 2
320
297

7

1.7101174

3.4202348
1.6464037
8.4414561

3.5481246

3532.

4.5185139
3.5481246

1.0303893

3532.)

5480

1.0540

4.3020

43.20

432 : x :: 64 : 76
76

2592
3024

64) 32832 (51.30
320
83
64
192

355

3532) 33 (9.3
31788
124 20
14128

48 e

Def 91 –

6279
230

200)6599 (32.5
600
509
400

5142.

330000

43.2 : x : 64.91

1.6354837
1.9590414
8.0193819 0

1.7883441

3.5766882
1.6464037
8.4881166

3.7112085

5 . . . .

6.2887915
4.5185139

1.8073054

6.4 H.P.

Second Test

Dep a Lamp. 72 – 72

Boil 63.64

6279
870

2096649 (33

649 43.21 : 635 72

1.6354837
1.8573325
8.1972263

1.6910426

3.3820852
1.6464037
8.4814861

3.5099750 ft lbs 3235

6.4900250
4.5185139
0.0853.89 H.P 10

432
72

864
3024

635) 31104 (5

64) 31104 (48
256

550
512

380

33) 106360 (3221.
99

73
66

70
66

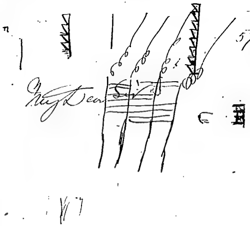
3221) 33000 (4.
25184

40110

Ra Para Paradise Lost

12
96
576

My

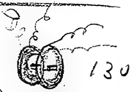


My Dear Sir

Small coils

~~$3\frac{25}{100}$~~ ~~3.25~~

x $3\frac{25}{100}$ ohms
$3\frac{27}{100}$ ohms



130

large coil
32.50 ohms (x)
33.50 ohms

378

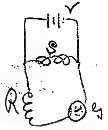
5 1

33) 115220 (3491
99
162
132
302
297
60

3491) 32000 (9,4
31419
15810
13964

1 4 3

Res of a Battery



$\frac{5}{25}$ $\frac{1}{5}$ $\frac{20}{25}$ $\frac{4}{5}$

$$C = \frac{E}{r + \dfrac{S(R+g)}{S+(R+g)}}$$

current through the gal =

$$\frac{E}{r + \dfrac{S(R+g)}{S+(R+g)}} \times \frac{S}{(R+g)+S} =$$

$$\frac{E\cancel{(S+(R+g))}}{r(S+(R+g)) + S(R+g)} \times \frac{S}{\cancel{S+(R+g)}} =$$

$$\frac{ES}{r(S+(R+g)) + S(R+g)}$$

$$C = \frac{E}{R+g+r}$$

$$\frac{ES}{r(S+(R+g)) + S(R+g)} = \frac{E}{R+g+r}$$

$$ES(R+g+r) = \cancel{E(rS+rR+rg)} =$$

$$E(rS+rR+rg+SR+Sg) =$$

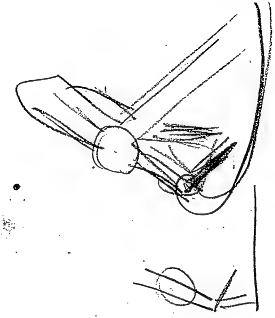
$$\cancel{ESR} + \cancel{ESg} + \cancel{ESr}$$

$$\cancel{ErS + ErR + Erg + ESR + ESg}$$

$$\cancel{ESr \quad ErS \quad ErR \quad rg} =$$

$$\cancel{ESR} + \cancel{ESg} + \cancel{ESr}$$

$$\cancel{ErS} + Erg + ErR + \cancel{ESR} + \cancel{ESg}$$



$$\frac{ES}{r(S+R+g)+S(R+g)} = \frac{E}{R_1+g+r}$$

$$\cancel{ESR}+\cancel{ESg}+\cancel{ESr} =$$
$$ErS+ErR+Erg+\cancel{ESR}+\cancel{ESg}$$

$$ESR_1+\cancel{ESg}+\cancel{ESr} =$$
$$\cancel{ErS}+ErR+Erg+ESR+\cancel{ESg}$$

$$ESR_1 = ErR+Erg+ESR =$$

$$r = \frac{ESR_1 - ESR}{ER+Eg} =$$

$$r = \frac{S(R_1-R)}{R+g}$$

$$r = \frac{S(R_1-R)}{R+g}$$

Def	V	Def	V	Def	V
Def	20 cell =	32 def	[illegible] = 1.4814 Def		
1	.675	21	14.17	41	27.67
2	1.35	22	14.85	42	28.35
3	2.02	23	15.53	43	29.02
4	2.70	24	16.20	[illegible]	29.70
5	3.38	25	16.87	[illegible]	30.37
6	4.05	26	17.47	[illegible]	31.05
7	4.73	27	18.22	47	31.72
8	5.40	28	18.90	[illegible]	32.40
9	6.08	29	19.57	[illegible]	33.07
10	6.75	30	20.25	[illegible]	33.75
11	7.43	31	20.92	51	34.42
12	8.10	32	21.60	52	35.10
13	8.78	33	22.28	53	35.77
14	9.45	34	22.95	54	36.45
15	10.10	35	23.62	55	37.12
[illegible]	10.80	[illegible]	24.30	56	37.80
[illegible]	11.47	[illegible]	24.97	57	38.38
[illegible]	12.15	38	25.65	58	39.15
19	12.83	39	26.32	59	39.82
20	13.50	40	27.00	60	40.50

log 1.48144 = 10.170695 142

61	41.17	80	54.00	98	66.15
62	41.85	81	54.67	99	66.82
63	42.52	82	55.35	100	67.50
64	43.20	83	56.02	101	68.17
65	43.84	84	56.70	102	68.85
66	44.55	85	57.33	103	69.36
67	45.22	86	58.05	104	70.36
68	45.90	87	58.72	105	70.87
69	46.57	[illegible]	59.40	106	71.55
70	47.25	89	60.07		
[illegible]	47.93	90	60.75		
72	48.60	[illegible]	61.42		
73	49.27	92	62.10		
[illegible]	49.95	[illegible]	62.77		
[illegible]	50.62	[illegible]	63.45		
[illegible]	51.30	95	64.13		
[illegible]	51.97	96	64.80		
78	52.65	97	65.47		
79	53.32				

✓

107	72.23	121	81.67	135	91.12
108	72.90	122	82.35	136	91.80
109	73.58	123	83.03	137	92.47
110	74.25	124	83.70	138	93.15
111	74.93	125	84.37	139	93.82
112	75.60	126	84.97	140	94.50
113	76.28	127	85.72	141	95.17
114	76.95	128	86.40	142	95.85
115	77.60	129	87.07	143	9[illegible].52
116	78.30	130	87.75	144	97.20
117	78.97	131	88.42	145	97.87
118	79.65	132	89.10	146	98.55
119	80.33	133	89.78	147	99.22
120	81.00	134	89.45	148	[illegible]
				149	100.57

150	101.25	166	112.05	181	122.17
151	101.92	167	112.72	182	122.85
152	102.60	168	113.40	183	123.52
153	103.27	169	114.07	184	124.20
154	103.95	170	114.75	185	124.83
155	104.62	171	115.43	186	125.55
156	105.30	172	116.10	187	126.22
157	105.88	173	116.77	188	126.90
158	106.65	174	117.45	189	127.57
159	107.32	175	118.12	190	128.25
160	108.[illegible]	176	118.80	191	128.92
161	[illegible]	177	119.47	192	129.60
162	109.35	178	120.15	193	130.27
163	110.02	179	120.82	194	130.95
164	110.70	180	121.50	195	131.63
165	111.34			196	132.30
				197	132.97

198	133.65	216	145.80	235	158.62
199	134.32	217	146.47	236	159.30
200	135.00	218	147.15	237	159.97
201	135.67	219	147.83	238	160.65
202	136.35	220	148.50	239	161.32
203	137.02	221	149.17	240	162.00
204	137.70	222	149.85	241	162.67
205	138.38	223	150.53	242	163.35
206	139.05	224	151.20	243	164.02
207	139.73	225	151.87	244	164.70
208	140.40	226	152.47	245	165.37
209	141.08	227	153.22	246	166.05
210	141.75	228	153.90	247	166.72
211	142.43	229	154.57	248	167.40
212	143.10	230	155.25	249	168.07
213	143.78	231	155.92	250	168.75
214	144.45	232	156.60	251	167.42
215	145.10	233	157.28	252	170.10
		234	157.95	253	170.77

254	171.45	275	185.62
255	172.12	276	186.30
256	172.80	277	186.97
257	173.38	278	187.65
258	174.15	279	188.32
259	174.82	280	189.
260	175.50	281	18967
261	176.17	282	190.39
262	176.85	283	191.02
263	177.52	284	191.70
264	178.20	285	192.33
265	178.84	286	193.05
266	179.55	287	193.72
267	180.22	288	194.40
268	180.90	289	19507
269	181.57	290	195.75
270	182.25	291	196.42
271	182.93	292	197.10
272	183.60	293	197.77
273	184.27	294	198.45
274	184.95	295	199.13

296	199.80
297	200.47
298	201.15
299	201.82
300	202.506

951)4900(.05
155

921.7900(.085
1368
5320

2

1.6879746
2.9782947
$\overline{2}$.7096799

1.7974271
2.9642596
$\overline{2}$.9333675

.0512 .0857
.0512
.0345

1000 − 48.75

48.75 mm leading wires

79 leading wire + machine

1000.00
48.75
951.25

48.75 : 951.25 :: 1 : X

2.9782947
1.6879746
0.2903201

1000
79
921

1.95

951.25 : 48.75 : 1 X
921 : 79 : 1 : X

115 through 10000

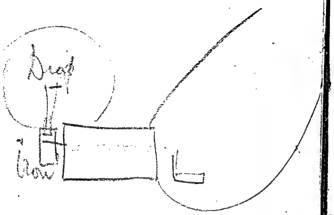
33% . 10000

52

52) 3 3 8 0 0 0 0 0 0   (65000
3 1 2 +

260
260

2 1/2



Feb 6

Metric Experiment

68.D = 300

$$\frac{1.08 \; 6}{6.48}$$

6.48) 300000 (46.2 4
25 92

4080
3888

1920
44

46.3
6
2778

3

46.2
6
277.2

46.3
648

3704
1852
2778

290024

46.2 Def = 1V

Res of No. 6

10

2.0
2.0
4.00
4.4
1600
1600
17.604
70.4 4
10.
281.6
2

40
40

134
134
536
402
134
.17956
7854

.07854

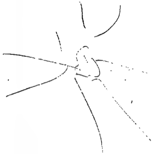
.7854
12
31416
7854
.1099.56
40
4398240

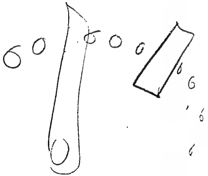
$\boxed{1}$

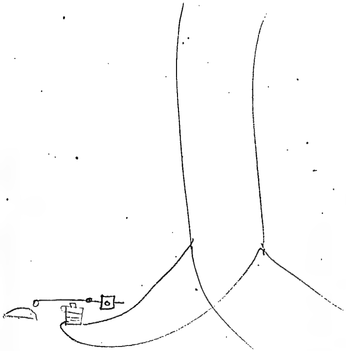
.17956
40
7.18240

1.357

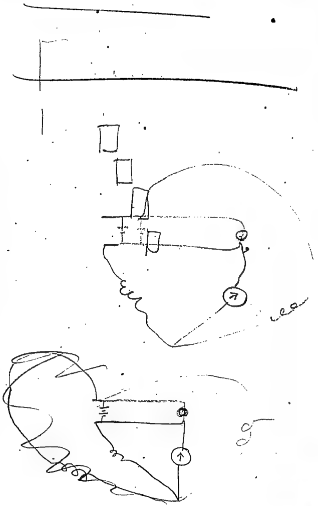
.4398

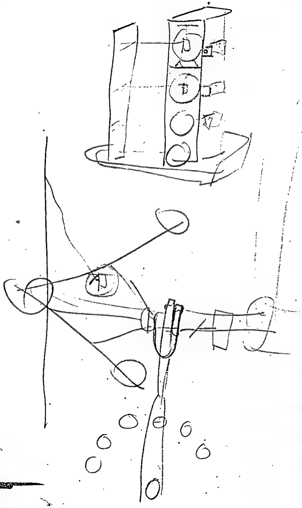






110





$\frac{x}{10}+10=\frac{x}{4}$

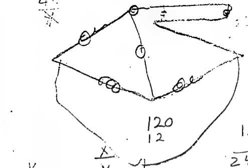
120

$2x+200=5x$

$2x+200=5x$

357 − 300

6



$\frac{x}{10}+10$

$\frac{4x}{\cancel{x}}$

120
12

120
120
2400
120
1440
144

$\frac{x}{10}+10=\frac{x}{\frac{x}{4}}$

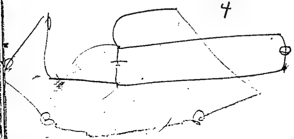
$4x$

$3x$

$\frac{3x}{3x^2}$

$x+100=x$

4 | 4x
4

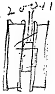


$\frac{x}{10}+10=4$

$\frac{x}{4}+x=10+\frac{1}{30}$

$x+100=40$

$3x+20x=$



233

30

30!164 | 233 | x
164

1273
233
1050

30) 38
30
8

$\frac{c}{\varepsilon}$

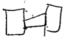
$\frac{\varepsilon}{c}$

$\frac{\varepsilon}{e}$

$cr-\varepsilon$

R

R



$r=\frac{\varepsilon}{c}$

Def on Magnet   Deep

31

112	4.0984360
141	1.6464037
	7.8507809
	3.5956206 — ft Cos
	6.4043704
	4.5185139
	0.9228543

8.4 H.P.

30

119

157

40

4.1510940
1.6464037
7.8041003

3.6015980 ft Cos

6.3984010
4.5185139

0.9769149

~~8.7~~ H P, 8.2 H P.

Dec 14th 1880

%10 Magnet	machine		#5. magnet	machine	
0	18	18	0	12 -	12
0	28 -	28	1	20 -	20
1	40	40	2	32	31
2	51	52	3	40	40
3	63	63	2	50	50
3.5	74	74	4	59	59
5	89	89	5	70	70
8	107	107	5.5	85 -	85
10	119	119	7	105 --	105
11	130	130	11	122	122
16	140	140	14	131	131
22	145	145	11	138	138
32	155	155	19	142	142
68	170	170	30 - 31	150	150
			65	165 -	168

Dec 14

1 W. = 124

2

$$3\overline{)340}$$
170
113

Lamp 184

166 ohms

185
2
3370
123

15) 64 (427.
63
40

4.1798102
1.6464027
7.7798919 2

3.6061058

5.3938942
4.5185139

9.9124081

8.2 H.P.

1/4 lamp

16

111.0
138 R

4.0906460
1.6464037
7.8601209

3.5971706

1.4684
59266
74070

8.3 H.P.

123

15

Aug 19

105.
136 R

4.0423786
1.6464037
7.9664611

3.5552434

6.4447566
4.5785129

0.9632105

9.2 H R

4.0423786
1.6464037
7.9788107

3.6675930

6.3324060
4.5718739

0.9509199

8.9 H.R.

105. $R = R_1$

$C = \frac{E + E_1}{R}$ $= CR = E + E_1^x$

$C_1 = \frac{E - E_1}{R}$ $CR = E - E_1^x$

$E_1^x + E = \underline{CR}$

Maschinen

$\left.\begin{array}{l} R \text{ of } x. \\ R_1 \text{ of } y \end{array}\right\} = R + R_1 \left| \begin{array}{l} E \\ E_1 \end{array}\right.$

$C = \frac{E + E_1}{(R + R_1) R_2} =$ $CR = E + E_1$

$C_1 = \frac{E - E_1}{(R + R_1) R_2}$ $C_1 R_2 = E - E_1$

$R_2 = \frac{E + E_1}{}$

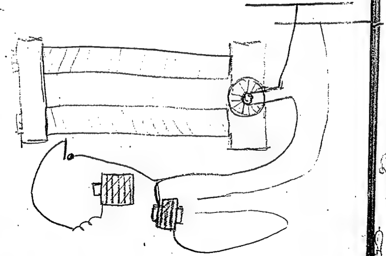
$R_2 = E + E_1$

$R_2 = \frac{E - E}{C_1}$

105 – U from 130 – 160

4.0423786

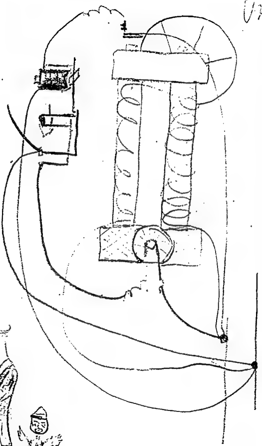
4.0423786

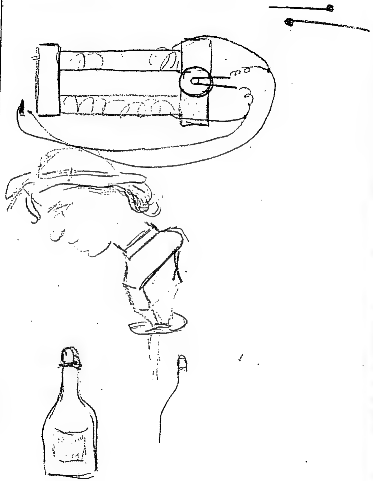


Dec 21 1880

Edison's Motor

Francis





18860
4
23340
~~1167~~ ohm

18840
4800
23640
113,2

$$\begin{array}{r} 1080 \\ 90 \\ \hline 91.0 \end{array}$$

90 : 910 : 10 : 4

$$\begin{array}{l} 2.9590414 \\ \cancel{2.0000000} \\ 8.0457575 \\ \hline 2.0047989 \end{array}$$

Lamp to get its curve Jan 20 1880

Res	Ele.	Can	R	E	C
Cold 176	13.50	0	116	99.22	14
129	66.85	1	116	99.94	15
126	75.60	2	115.5	101.25	16
125	79.65	3	115	101.9	17
122	84.37	4	114.5	103.29	18
121	85.[illegible]2	5	114	104.62	19
120	87.75	6	113.5	105.30	20
119	89.45	7	110	108.	25
118.5	91.12	8	109	110.70	30
118	93.82	9	107.5	112.72	35
117.5	94.50	10			[illegible]
117	95.17	11	105	117.45	50
116.5	95.85	12			
116	97.87	13			

$$\begin{array}{r} 31406 \\ 3800 \\ \hline 2\,)\,35206 \\ \hline 176 \text{ ohms} \end{array}$$

71 : 14000 :: x : 35206

$$\frac{x}{35206} = \frac{71}{14000}$$

R	C	V	R	C	V
Cold					
174	0	13,50			
133	1	7087			
125,5	5	8775			
122,2	10	95,85			
120	15	101,25			
118,[illegible]	20	106,65			
116,5	25	109,35			
116[illegible]	30	112,05			
114,5	35	114,75			
112 -	50	118.80			

31406
3500
2 | 34906
174

18840
5600
24440
122

25127
1500
2 | 26627
133

12,563

18840
4500
23340
1167

18840
5600
24440
122,2

18800
5200
24000
120

18840
4800
23640
118,2

18840
4100
22940
1147

18840
4350
23190
115,95

.01 machine Jan 21 1881

def, Rev 76

76 1030

78 1030

53

53 11000 : 65

53) 650000 (122

.12560

.500

12560

.577

87920

87920

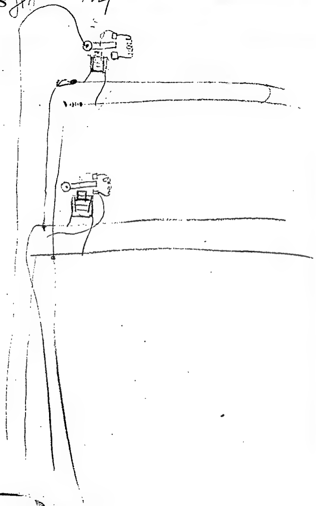
62800

1052) 7247.120 (138 365.

1.124900

 Jr?

Feb 4.



C F

37	7	139
1	2	147
2	3	157
3	4	167
4	5	183

2

800 : 200 × .01875
800
14.9600

200) 14.9600 (.6

.0187 00
200) 14.9600 (.07

.1 [illegible]
139
861

861 : 139 : × .01875
.861
187
11 22
1 4 9 6

139) 16100 7 (.11
139
220
139

453.6)1000.0 gr. (2.20
9072
9280
9072
2800

1390
22
2780
2780
305800 ft = 1 Cal

4403
2

2 1/2 2

1 C = 22.7 W

772
2.2
1544
1544
1698.4 ft lbs. per Cal
.24065
84920
84920
91904
67936
88968
~~8779960~~
408.7199 60

1 W = 441.3 ft lbs.

5
5 3 2

1390 ft lbs

1,390 ft

1390 = Calorie
.240
55600
2780

443.0
772
202

1544
1544
1698.4 ft lbs

)1698.4

4)100(25
20

4/0)40

44.3 ft w.

W = 44.3 ft lbs

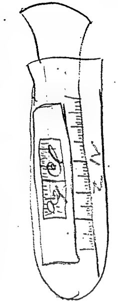
1698.4

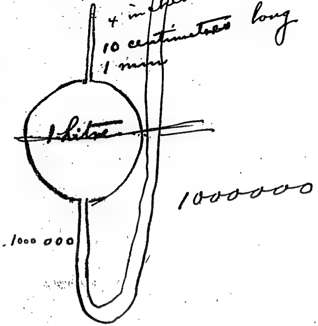
1698.4 ft = 1 C

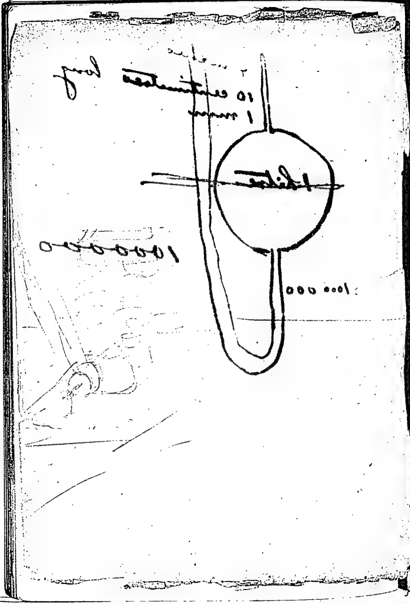
.2) 16981.40000 (

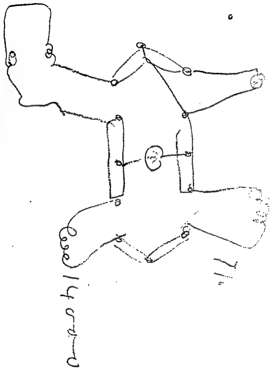
100) 1698.4 (16.98
100
698
600
984
900
84

16.9
24
676
338
4056




4 inches
10 centimetres long
1 mm
~~1 litre~~
1000000
.1000 000


10 centimeters long
1 micron
1000000
1000 000


14 cm

$\frac{5}{9} - 32 = e$ $\frac{5}{9}(7 - 32) = e$

$e = (-\frac{5}{9} 7 + 32)$

46

$\frac{5}{9}(7 - 32) = e$ $\frac{5}{9}(7 - 32) = e\ 70$

$\frac{57}{9} - \frac{160}{9} = e$ $\frac{57}{9} - \frac{160}{9} = 70$

$57 - 160 = 630$

$57 - 160 = 9.6$

$e = \frac{57 - 160}{9}$

$\frac{57}{9} - \frac{160}{9} = e$

$57 - 160 = 9e$

$57 - 160 = 414e$

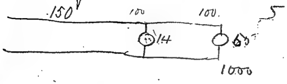
$\frac{57}{9} - \frac{160}{9} = 46$

$-\frac{160}{9} = 9C$ $\;\; 160 \;\; C18$

70

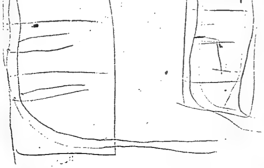
$-\frac{160}{9} = 46$

5704



$\frac{1}{3}$ $\quad$ $\frac{2}{3}$

$-160 = 504$

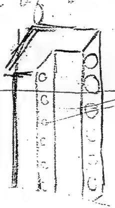


$-\frac{160}{9} = C$

46
32
178
2
15 9 $\left| -\frac{160}{1} = 9C \right.$
125

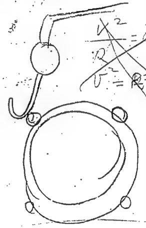
$\frac{5}{9}(F = -32) = C$

Pot. Ferricyanide 3 parts
Citrate of iron ammon 5
H_2O 40



Pot. Ferricyanide 3 parts
Ammon iron citrate 5
water 40

15 $\frac{12.5}{60}$ 62



$\frac{V^2}{R} = 44.3$

$V^2 = R \times 44.3$

(12.5

100

200

400

800

$\frac{V^2}{R}$ 44.3

~~44.285~~

$\frac{V^2(44.3)}{R}$

Menlo Park Notebook #105 [N-80-06-02]

This notebook covers the period June-August 1880. Most of the entries are by Charles Batchelor. There are also a few entries by Neal Van Cleve. The first few pages contain a record of carbons, kept by Van Cleve. Following this are notes and drawings by Batchelor relating to carbon experiments; notes and drawings of a bamboo splitter, a clamp-making machine, and an instrument for attaching carbons; notes on "faults to be looked for" when testing carbons; drawings of a lamp socket; and notes and drawings of insulation for a dynamo armature. The book contains 284 numbered pages. Pages 137-138 were torn out of the book and taped in between pages 92 and 93. Pages 16-19 contain skeleton tables that were never filled in. These tables have not been filmed.

Blank pages not filmed: 118-133, 142-239, 242, 247-266, 277, 280-281.

Missing page numbers: 3-4, 99-100, 137-138, 243-246, 267-276.

June 2nd/1880

Best fibre 9/1000 x 12/1000
carbonized alone

Carbon Record

Van Cleve

July 2. 1880

Date	Material	No. Taken in	Taken out
June 23	Platinum chloride Bast) alcohol	1	1
July 9th	Ammonia Salts of Platinum Bast)	1	1
	12x12 5/64 or not 6 inch long (Bast	5	5
Paper Board	also paper Carbon 12x12 1/2/1000	6	1
	also 9/1000 x 12/1000 Bast fiber	2	2
	also Palmetto fibers	4	4

Remarks

Date	Material	No. Put in	No. Taken out
July 7	12x10/1000 Palm leaf fiber	6	3
	12x12 Also Bamboo fiber	6	3
June 9th	Rye Straw 12x10/2/1000 Felt on one side	6	1
10th, 1880	Bristol Board fibers 6 12x12	6	2
July 12th	12x12 Bamboo fibers Regular size		4

Remarks

1 Bituminus Coal

2 Kerosene

3 Paraffin

Date	Material July 28.	Nos Points	Order out
4	Naphthalene		
5	Benzine		
6	Camphor		
7	Turpentine		
8	Aniline oil		
	Anthracine		
10	Regular in Kerosene		

Date	Material	No. Put in	Taken out
	Bisulphide Carbon		
12	Glycerine		
13	Oil Myrbane		
14	Asphaltum		
15	Regular ~~without anything~~		
16	Cod liver oil		
17	Castor oil		

Remarks

Date	Material July 28	No. Put in	Taken out
18	Nothing in at all made ~~to compare the others with~~		
19	Narrow straight one		
20	Regular		
21	Tar		
22	Bisulph Carbon		
23	" " "	Chalk	

Remarks

Date	Material	No. Cut in	Taken out
24	Small narrow moulds		
25	wide moulds with a little tar on ends to prevent cracking		
26	Tar painted on them		
27	wide a little tar put in paper to make vapour of tar.		

July 13, 1880

6 Bamboo fibres the ends dipped in Sol. Double Chl. of Amm and Pt before Carbonization none of it to be got on thin part ~~the ends dipped~~ And 6 a portion of thick solution dropped on ends and recarbonized

OK

2 on page 139 B 57
2 " " 137
2 " " 161

Try. exp. Double Chl NH_4 239 / 77

1 6 Bast fibres

OK the end dipped in Double Chloride Amm. and Pt and Carbonized

2 6 Bast fibres (carbonized)

OK a portion of a drop put on each end and recarbonized

July 13 1880
Chas Batchelor

No 3 Take 6 Bamboo fibres
Dip ends in Sol. Chl ~~NH4~~
~~and~~ Pt and Carbonize

---

4 Take 6 Bamboo fibres
(Carbonized)
put portion of a drop
on ends and recarbonize

July 13 1880
Chas Batchelor

Cut from thick end of Cane
4 pieces 3.75 long — 3.02
.123 wide — .894
.0835 thick — .645

From thin end of Cane
3 pieces 3.00 long —
.121 wide —
.060 thick —

After Carbonization

percentage of shrinkage
See page 29

July 13 1880
Chas Batchelor

5 Take 6 old paper Carbons and heat ends with double Chl. NH_4 and Pt put in Lamps

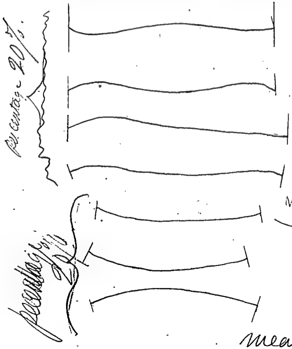
6 Bamboo pieces $\frac{1}{8}$ square
OK laid in mould and carbonized Edison wants to study them under microscope OK

7 ~~Have Haid make a~~
OK ~~strong alcoholic solution of double chloride NH_4 and Pt want it~~

& soak well into the pores of fibres + carbons - Ask him about ~~strength~~ ~~and~~ etc of same

July 13 1880 Chas Batchelor

length



2·93

3·00

3·13

3·03

4 | 12·09

mean 3·02

2·35

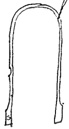
2·30

2·40

3 | 7·05

mean 2·36

8 Make two Bamboo fibres
with a fault in so:-



OK.

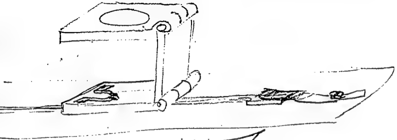
9 6 Bamboo - Carb. -
~~4~~ soaked in hot Syrup
and re Carb.
4 of these resoaked & Carb.

2 of these last resoaked
& Carb.

Notes - July 14 - 1880

I see some lamps have the carbon cracked in the clamp so that one portion is red and another black - Cause irregular surface for clamping = Remedy make mould right so ~~that~~ there is not too much room anywhere

Testing fibres Aug 2d 1880



Faults to be looked for

1 Some places cut into or narrower than others

2 Some places where there seems to be a portion of a fibre torn out

3 Some places where there seems to be a split extending a short distance

4 Pierces at ends cut too deep in

5

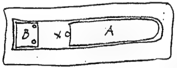
Carbons

Aug 4th 1880

Chas Batchelor

On our gas furnace (which works elegantly) we can make an improvement by making it up of bricks moulded right shape & binding together so as to allow a little shrinkage and expansion

I find that in our mould sometimes the large weight moves by reason of the small weight sticking this I remedy by putting a pin at X which is made moveable

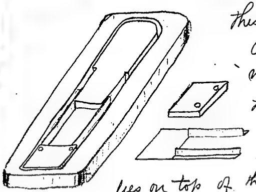


The sticking of the small weight is due in some cases

to small globules of metal or other substance coming out of the nickel at a high heat

These globules sometimes actually hold up the small weight ~~so that~~ its pressure is ~~not felt~~ on the fibres ~~and consequently~~ the ends are ~~not flat~~ — In such a case when the fibre shrinks it pulls the weight by jerks and when finished is corrugated

A good way to obviate part of this is to make a mould like



this:-
A thin plate of nickel lies under the fibre and has a side turned up — the weight lies on top of this plate with the fibre ends in between — The sides of this plate ~~has~~ also confine the body of the fibre to a smaller chamber thus making less liability to oxidization

Aug 11 1880
Chas Batchelor

Aug 5 1880

Chas Batchelor

In carbonizing chamber I let the fibre ends rest on carbonized tissue paper and also in another on uncarbonized tissue - both of these brought the carbons out very straight and flat I shall try both on a full set in our gas furnace as it will prevent weight sticking ——

Later This I have tried in nine chambers together in gas furnace and they were all good. CB

Aug 4 ~~4~~ 1880

two holes put through gas
one burner under opposite
Ends of mold
in regard to the
Bending of the carbon

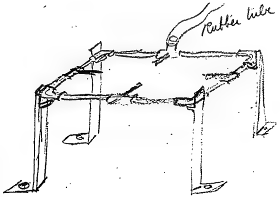
Carbons Aug 4th 1880
Chas Batchelor

We are considerably bothered with the carbons bending over whilst they are on the pumps We think this must be due to ~~t~~ unequal heating so I have ~~made~~ put up 2 fibres in moulds and heated up only one end of each in the preliminary heating

Carbonizing Aug 5th 1880

In making the gas and wind pipes for the other moulds I propose to arrange it so ~~that~~ each pipe will ~~lift out~~ of the way and connect ~~with~~ flexible joints of rubber ~~to main~~

Chas Batchelor



Carbonizing   Aug 5 1880

Chas Batchelor

It would be more economical in our gas carbonizing furnace to blow in hot air instead of cold and this might be done so:-

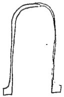
5·00 = ~~40~~ = 1·00 = 4·00
5·10 — 1·02 4·08

51
102

4.

The carbons bend over in bringing up on the pumps — This may be due to:

1 Too low a heat in carbonizing



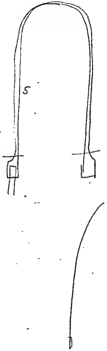
If they are not heated sufficiently in Carbonizing when they are put on the pump and heated a great deal higher the outside shrinks more than the inside; and the clamps being held ~~tight~~ it has to bend over to adjust itself — for instance we will say the outside line is 5·10 and

the inside 5' then a shrinkage of 20% would make it 4'08 to 4' and a difference of only '08 instead of '10 - now the carbon in last heating as the clamps are fast the outside must necessarily take another position in order to become proportionately shorter —

Now we will make the following experiments: —

over page 61

5·



20°

5 — 4
5·10 4·08

Carbonizing Aug 8th 1880

1st Make 3 in ordinary
XXX manner but not extra
heat in muffle OK

2nd Make 3 in ordinary
XX manner with intense
heat in muffle
~~put them in [illegible] when put in muffle~~

3 Make 3 with uneven
XX heat on preliminary heating
and intense heat in muffle

4 Make 3 without preliminary
heating but intense heat
in muffle

5 Take 3 ordinary ones
xxx from top of new gas furnace
with 15 in OK done p 201 B. 57

6 Take 3 from bottom of p 201 Book 57
xxx ditto OK done

7 Take measurement of
3 after preliminary heating

8 Take 3 from middle of
x gas furnace mould and
bring to high heat in muffle

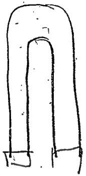
9 Take bunch of about doz. from
xx gas furnace lot and bring to
incandescence over to 71

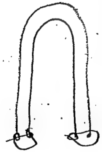
Aug 8 1880

Notes. The original length of all is 6 $\frac{21}{32}$ inches —

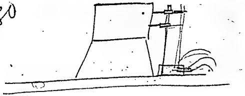
After Carbonization total length from top of curve to base of clamp is as follows —

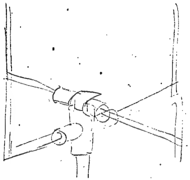
No	Length	Remarks
1	2 $\frac{13}{32}$	
2		
3		
4		
5	2 $\frac{13}{32}$	
6	2 $\frac{13}{32}$	
7		
8		
9		
10		
11		
12		

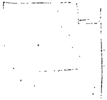




Furnaces
Aug 8 1880



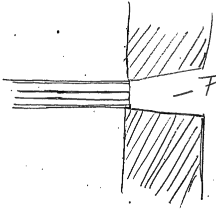




3 — $\frac{3}{8}$ gas cocks

1 Reducing coupling $\frac{5}{8}$ to $\frac{3}{8}$

2 Cross tees $\frac{5}{8}$ pipe



— Furnaces

Aug 8th 1880

Chas Batchelor

10 Take 2 of the old ones from
XX the gas furnace —

Carbonization

Aug 13th 1880

Chas Batchelor

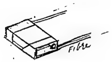
The cause of the bending over of the loop after it is heated in vacuo we thought was due to insufficient heating in carbonization but after a series of experiments ~~to determine~~ that point we came ~~to the~~ conclusion that whether ~~heated~~ slightly or to a high temperature some of each bent whilst others kept straight

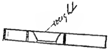
We then remembered that some bamboo fibres which were 4" long and of which we mad a great number almost all kept straight

we also remembered that almost
all these were put in the clamps
edgeways instead of flatways
this led us to ~~think~~ see that

~~probably~~ the way Bradley
cut them from the cane,
and the bending them flatways
afterwards, would leave the 'pith side'
on one face and the 'hard shell'
side on the other face unequal
shrinkage of course must occur
on two such faces and cause
the bending — We now made
a mould for carbonizing that
would hold the fibre edgeways

so:- this made moveable weight of three pieces the middle piece pressing out the sides to suit the shrinkage of the fibre in thickness





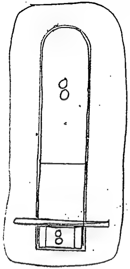
From this mould we tried some on the pumps and they not only were perfectly flat themselves but did not change their upright position with the most intense heat we could get on them

Chas Batchelor
Aug 13" 1880

Carbonization

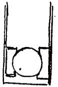
Aug 13 1880

Chas Batchelor



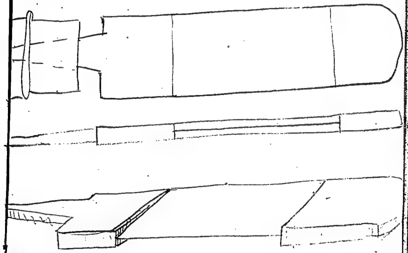
Mould with pin across to hold fibre tight so that it can pull the large weight down — wedge weight for keeping the clamp ends flat

Circular weight for keeping clamp ends flat



Aug 18th 1880

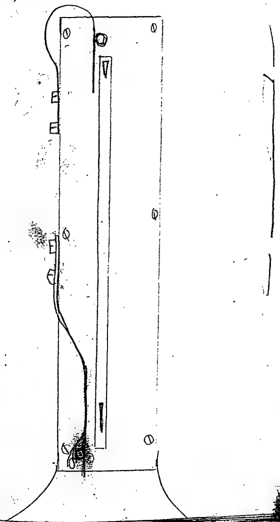
Make a Knife for splitting Bamboo so from an old file



Bamboo Splitter

Aug 18th 1880

Batchelor



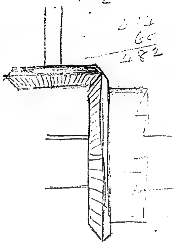
Might 600
300
900

29

137
168

22

482

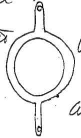


22 100
170
100

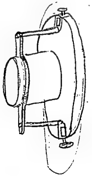
Dynamo Machines   Aug 24 1880

Chas Batchelor

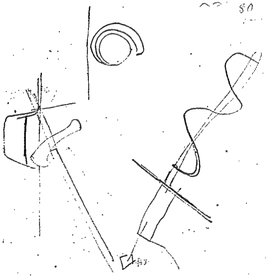
The connections on the back of the armature might be made in the following manner:— Cut out a number of pieces like this:—



now put together (insulated from each other) by mica) as many of such pieces as there are connections and set each one a little ahead of the other and connect to a plate holding the bindpost and wires by stud. screws



1.37
22
274
274
30.14
22 80



Crank Machine

Aug. 25th 1880
Chas Batchelor

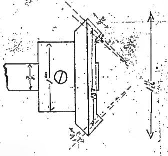
Bevel Wheels for Phonomotor movement

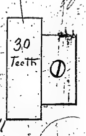
Large — 100 teeth — Pitch 4.00 — face $\frac{5}{16}$
Small — 30 teeth — " 1.37 — " $\frac{5}{16}$

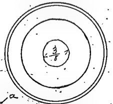
Pitch 22 —
Depth of tooth .10

Large bevel 58 degrees
between the gear

53½ Degrees
at the centre of face .098 deep







Pitch line 1.34
Whole Diam 1.46
3/8 hole.

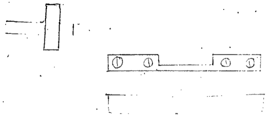
distance at point a must be 1/100 more than at b.

Small Spur gear Depth of teeth $\frac{93}{1000}$

Number of teeth 30

Large " " Depth " " $\frac{88}{1000}$

Number " " 180



17
17
4
38
32
114
6

17
14
13
50
24
200
100
1200

17×2−4

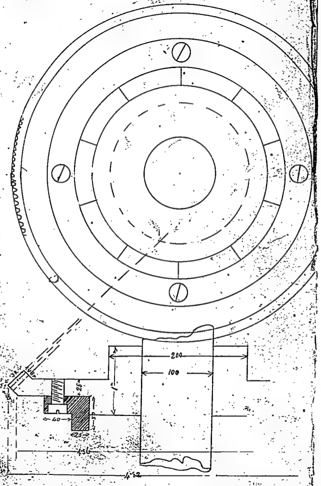
34
32
68
102
1088

17
136
272
32

Canal Machine
Large Gear.

Book 105

Aug 25 1880
Chas Batchelor

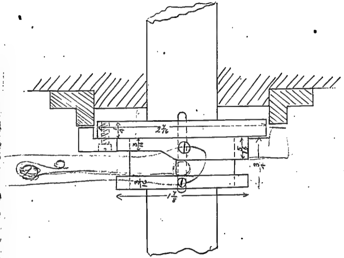


92 pitch 100 teeth
Depth of ~~tooth~~ in centre 1/10

Clutch for
Clamp Machine

Aug 25th 1880

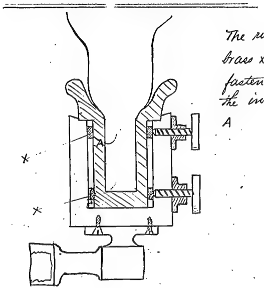
Chas Batchelor



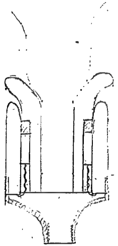
Lamp Socket

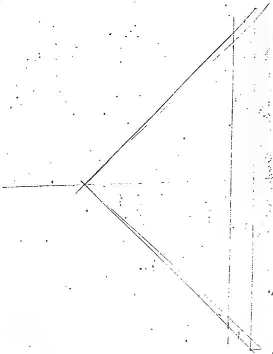
Aug 25th 1880

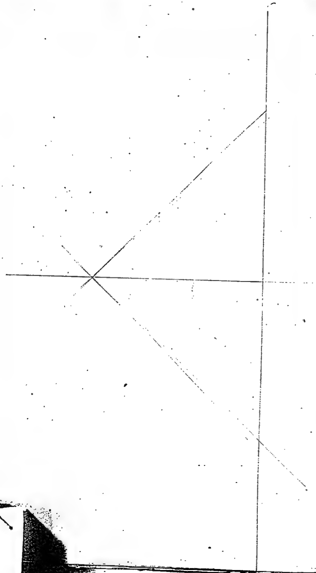
Chas Batchelor



The rings of brass x x to be fastened on to the inside socket A



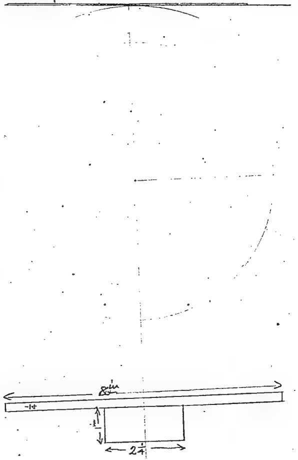


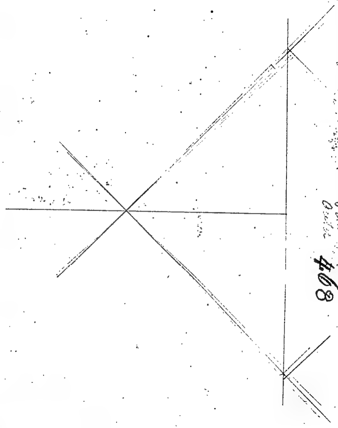


Pattern for Cam plates for Clamp machine

Aug 25 1880

Chas Batchelor

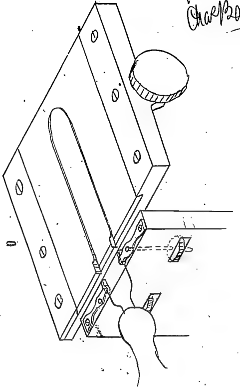


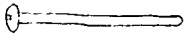


#68

Aug 26 1880
Chas Batchelor

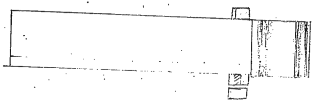
Inst for putting in Carbons





Clamp Machine Aug 30 / 1880

Bending Cam to be altered to new drawing

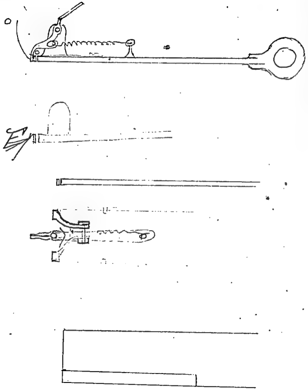


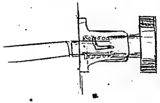
Clamp Machine

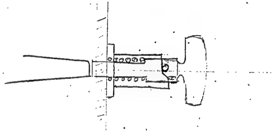
New motion for holding metal while punching

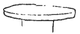
Aug 31st 1880

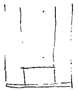
Chas Batchelor

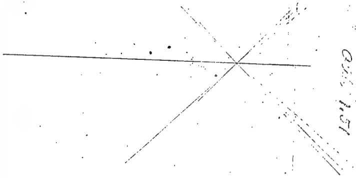












Pitch 1.37
[illegible] 1.57

The extrem Diameter of large					4.58
largest pitch		"	"		4.55
"	"	"	"	Small	1.37
"	extrem	"	"	"	1.47

1st $17 \times 3 \times 3\frac{2}{3}$ Comp.

170
170

170

170

170

716

1143 6

170

47

24

272

3264

17 — 5/64 4 1/4

1700
.64
6800
10200
[illegible]
5752,[illegible]
3011,2[illegible]

364

1700
800
1,360000
.24
544.0000
2720
32,640,000

138
7
966
138
138
1242

~~1242~~
~~26~~
~~700~~

69
4
276

18
4
72
368
2000
276
2636

-461

Million

$56.\frac{D}{1000}$

3.

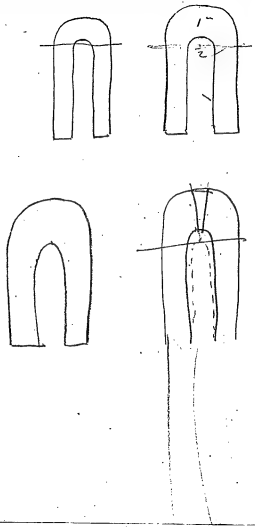
1000

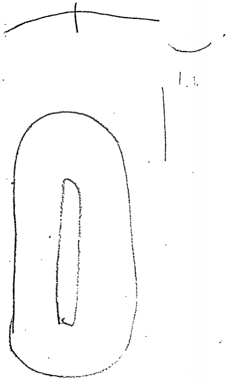
1000

7000000

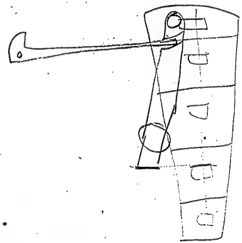
1000

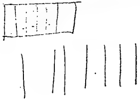
7,000,000,000

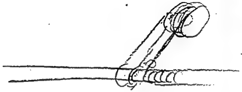




July 12th 1880 returned
25; Small lamps
not properly burned







Menlo Park Notebook #106 [N-80-09-28]

This notebook covers the period September 1880-March 1881. Most of the entries are by Charles Batchelor and Alex Welsh. There are also entries by Edison, Francis Upton, and W. A. Mills. The material all relates to the development of the electric lamp and consists primarily of notes and tables relating to lamps that were apparently made at the lamp factory and tested at the laboratory. Included are tests of lamps, made on vacuum pumps during September and October 1880, and resistance tests of lamps for the period November 1880-January 1881. There are also drawings of lamps and vacuum pumps, entries relating to carbon experiments, and a memorandum by Batchelor of things "to be attended to immediately" at the lamp factory. The label on the front cover is marked "Gedney." The book contains 284 numbered pages.

Blank pages not filmed: 54-55, 82-83, 156-187, 190-191, 194-199, 202-203, 206-213, 232-265, 272-275, 278-279.

Missing page numbers: 147-148, 281-282.

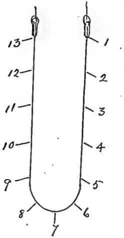
— Explanatory Marks —

Beginning Dec. 5

- Sent to Edison for experiment.
- Broken in handling by us.

Sept 28th 1880

Carbon loop - marked for showing position of faults ___



Experiments on pumps: Sept 29 1880

1 = Has Contraction 2 mm
Inside fall tube 5 mm
Outside " " 9 mm
Runs through 14¼ lb. Hg per min —
Contraction in this is twisted so that
the Hg strikes the cross tube —

This cracked with the pounding
of the mercury on the 6th lamp.

Pumps. — Sept 28th 1880

No 2		No 3	
Contraction	1·5 m m	Contraction	1·5 m m
inside tube	4 m.m	inside tube	4 m m
outside tube	7 m.m	outside tube	7 m m
Runs through per min	$11\frac{3}{4}$ lb	Runs through per min	15

(Remark:- the contractions of these cannot be right so we will take pieces of tubing for contraction)

Pump

4.		5	
Contraction made from tubing with hole 3/4 in long	1·5 mm	Contraction made from tubing hole 1/2 in long.	2 · mm
fall tube inside	3·5	inside of fall tube	4
outside fall tube.	9.	outside of tube	7
Per Min. Hg.	$17\frac{1}{4}$	Per min –	$23\frac{3}{4}$ lb.

6	7.
Hand made Contraction 2 m m Inside fall tube 4 Outside fall tube 7 per min Hg. $19\frac{3}{4}$ This only run one lamp and fall tube cracked Mercury splashed very much after leaving the Contraction	

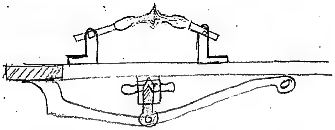
Oil testers —

	1880 Sep. 29	30	Oct 1 2	4	5	6 7	8	9
Good	16	24	64	11	41	28		41
Bad Spots at	4 6 7 13 4–6 10 12 10 11 2 2–4 6–9–12 8	2–7 7–2–12 2–4–12 4–6–8 1–2–10 3–7–12 2–6–12 13 7–13 1–7–13 1–7–13 2–13 6–7–8	1 7–8–13 2–7–12 6 2–12 2–5 6–7–12 2–12 1–3–6–12 2–6–9 2–6–8 2–9	2.6.8 1.9. 6.7.12 6.8.12 2.8.	2 11.12 5 2.4.10. 4 11 13 1.7.12	1.2.6.7.13 11.12. 8.9.11.3.4. 1.2.3.7.12 5.6.9.11. 2.3.4.10 5.6.10.11. 1 3 5 7 3 4 7 9 3.10.1.2 3.5.9.10		7. 7. 8. 13 1.3.5. 7. 8. 12. 1. 13. 2. 5. 12. 2. 4. 3. 8. 1.2.7. 11. 13. 3. 12.
Bright on one side	2	1	3 5 6–9–11 7–9–12 6–7–10–11 3–6–13	3		4		4
Bright in middle	1	1	3.7.10 3.6.10 6.8.12.13 12	1		5		3
Split ~~Broke~~ in Clamp.		1. 3	6.8.13.11. 6.13. 3.6. 2–5–11 6–12	1		6		5
Broke in handling	2	1	12 8 2.8.12. 2.5 12.	1		2		3
Split in fibre			5.13. 2.13. 2. 1.7.12. 9.6.12.					
Badly bent over			6.8. 2. 2.6. 2. 6.8.					
			8.9.13.					

Pumps	Sept 29	30	Oct 1st	2	4.5 mc 6	7	8	9	11	12
Good	22	20	11	25	14	18	15		32	11
Bad Spots				1						
Loss Vacuum	~~7~~			1						
Too Bright										
Too Dull			1						1	
Shows Blue all over										
Small Blue arcs.									1	
Busted on pumps	2			1		1			1	1
Leak in Glass				1					7	1
Broke in handling	1	1	1		1		1		1	
Split in Clamp	10	7	6	5	3	5	5		11	9
Bent over				1						
Broke by Hg running up									1	1
Total										

Including Oct 1st

1	6
2	23
3	7
4	5
5	5
6	24
7	15
8	11
9	7
10	7
11	4
12	21
13	13



Lots of lamps as sent up to the Laboratory

Sept 20

~~Lot~~ 1. To Consist of 159 lamps of Fibres generally not picked but made from the fishing poles we have bought

	Sent
Sept 28.	2 47
29	30
30	30
Oct 4	30
5	20
	159

Lot No 2.

To Consist of

Carbons made from Bamboo brought by Moore from New York Sept 29th. 1880 bought of Deltour 124 W 3 St

Poles were 8 to 9 ft long.

Joints were 8 to 12 in long for whole length of pole.

Diameter about 1 3/8

Color Ripe and Yellow —
Moderately thin shell —
very hard surface —
very Clean and smooth inside
the bamboo —
Said to be of Chinese wild
growth —
Sent Oct 4 — 33

Lot No 3

Same as lot No 2 only
whilst they were on the pumps
they were brought up to
70 candles for 2 or 3 seconds
Sent up Oct

Lot No 4

List of different pumps

1	2	3
Inside $3\frac{1}{2}$ mm	— $3\frac{1}{2}$ mm	— $3\frac{1}{2}$ m
outside $6\frac{1}{2}$ m	— $11\frac{1}{2}$	— $6\frac{1}{2}$
Pounds in Vacuum } - 10 inch from Contraction	Contract: $1\frac{1}{2}$	Cont.
	Pounds	Pounds $7\frac{1}{2}$
taken off	7 lamps	3 lamps
~~Broke straight across Straight~~	Broke straight across fall tube at night	Broke in night on the guage

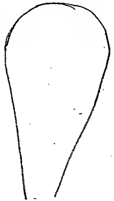
	4	5	6	7	8
Inside	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
Out	11	11	11	11	11
Cont.	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Pounds.	$13\frac{1}{2}$	$12\frac{1}{2}$	10	$10\frac{3}{4}$	$12\frac{1}{4}$
	Clamps broke in night in Fall Tube				

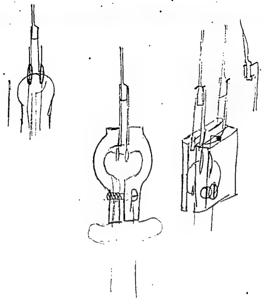
	9	10	11	12	13
Inside diam	3½	3½	3½	3½	3½
Outside diam	6	10	11	11	7
Contraction	2	1½	1½	1½	2
Pounds from cross glass	7	10½	9½	12½	8

	14	15	16	17	18	19	20
Inside	3½	3½	3½	3½	3½	3½	3½
Outside	7	8½	11	6½	6½	10	10
Contraction	2	2	1½	old	old	8½	1½
Pounds	6	11¾	11 5/4	6	8	6	11½

	21	22	23	24	25	26
Inside	3½	3½	3½	3½	3½	3½
Outside	10	6½	6½	10	6½	6½
Contraction	1½	old	old	1½	old	old
Pounds	13½	9	this has got larger fall tube half way down 9	12.	5½in	Pounds
						This fall tube opens out to about $\frac{3}{8}$ inside at ½ way down

27	28	29	30
Inside $3\frac{1}{2}$	Inside $3\frac{1}{2}$		
Outside 6	11		
Cont. old	Cont. $1\frac{1}{2}$		
Short fall tube	Rubber tube on fall tube		
Pounds	Pounds		



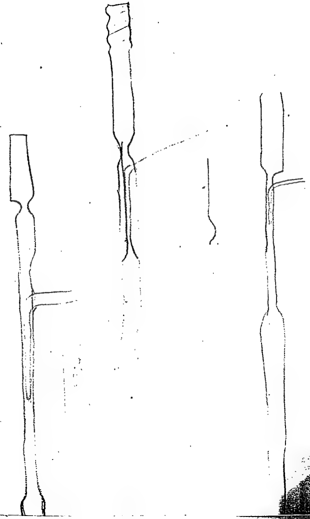


On Testers

	Oct 12	13	14	27	28
Good	64	15	19.	23	31
Spots	2. 10 2. 12 6. 8 9. 13. 3 2 2 2 1. 1. 3. 2 13. 1 2 1 2 4 all spots	12 1 1. 12. 2 all spots	3 3 6. F.	11 2 12. 11. 3 all spots	6. 2. 1. 13. 8 4 4. ~~9~~ 10 2 3 5 11. 13. 7.
Bright one side	3			2	
Bright Middle	1	1	1		
Split Clamp.	15	8	1	2	2.
Handling	6	1	1	1	2.
Split fibre					
Bent			1		
By Carrier				1	3.

Pumps Oct

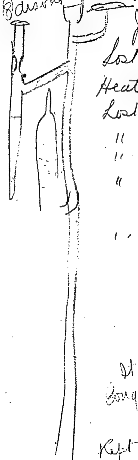
	13	14
Good	4	20
Spots		
Low Vacuum		
Too bright		
Too dull		
Blue all over		
Blue arc		
Bursts	6	2
Leak in Glass	1	1
Handling	2	
Split Clamps		
Bent		
Hg.	1	



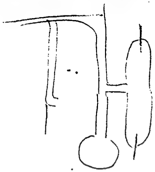
Oct 19th 1880

Put on a Lamp on the

Edisons pump time 2·18



Just beginning to run along	2·32
Lost spark at (small coil 4 cells)	3'45
Heated up for instant	3-52
Lost spark heated again	4'05
Lost spark heated again	4'09
" " " "	4'10
" " " "	4'12
" " " "	4'14
	4'17
" " " "	4 18
	4-19
	4:20
	4 20
a white Corona	4'20
	4-21
	4-21
	4 24
It now has to be heated	4-27
longer before spark comes	4·29
	4·30
	4-31
Kept on half min —	4-34



4 37 Kept on half min
4 39 Kept on 1 min
Took off the coil to put on
other pump
4'40 Water for $\frac{1}{4}$ hour
4 55. No spark when heated
5 oclock Keept the lamp at
~~high heat~~ 20 candles and no
spark
Sparks occasionally
5'10 Current on and no spark
5 18 for 20 minutes

Sealed off and sent
up to Francis

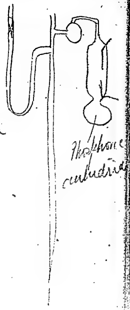
This we make model

Contraction	·020
tube	·090

New pump with drying tube

Put on 442

445 $\frac{1}{8}$ in along wire
447 all along wire
448 all over tube
4·49 from Bluish to Reddish
4·54 Red on one pole & blue on other



To be attended to immediately

Put up the wine cask for tank

Make lead lined chamber for dipping

Make tank wood for same

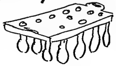
Make Hood and Chimney for same.

Make tank for sprays.

Make ~~tank~~ for water bath.

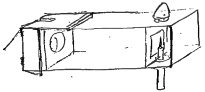
Make 12 lamp holders for dipping

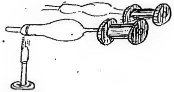
Make racks for drying and holding lamps



Have Winans connect barrel and pump to cistern —

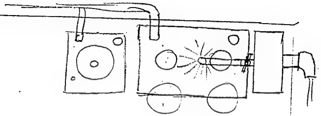
Ditto make spray and flow off water pipe from all tanks.





Carbonization

Fibre	No in Box	Over long	$2\frac{7}{16}$	$2\frac{15}{32}$	$2\frac{1}{2}$	$2\frac{17}{32}$	$2\frac{9}{16}$	$2\frac{19}{32}$	$2\frac{5}{8}$	$\frac{21}{32}$
Bamboo No 1	15	2			1	2	7	2	1	
Bast	16	3			1	1	8	2	1	
Bamboo No 1	16				1	3	9	3		
Bamboo No 1	19	2			5	6	5	1		
Bamboo No 1	17									



Resistance of lamps when cold before current on them, Bamboo Nov. 16

~~360~~ 660
~~270~~ 430
~~200~~ 360
2500
775
950
2000
2000
2450
1100
870
470
390
440
900
440

Lot 1. Bast fibre 1 hour
carbonizing 1 hour Nov. 16.

950 in place one broken
750 700
700 670 after heating
700 in gas flame
690
700

Lot 2. Bamboo under same condition
as Lot 1 carbonized for
five hours

750
650
650
675
675
650

Lot 3
Lamps carbonized in regular wac in 15 minutes and tested and found to be good

※1	700	Ohms
2	1.070	
3	980	
4	1000	
5	625	
6	650	
7	1020	
8	760	
9	2450	✓
10	640	
11	525	✓
12	675	

Lot 2

# 13	740
14	950
15	450 ✓
16	1200 ✓
17	750
18	1150
19	1050
20	870
21	900
22	680
23	580
24	610
25	600
26	950
27	750
28	780
29	650
30	900

Nov. 15

Exp When carbon heated gas flame resistance increased—

Pt lamps 765 Ohms

Hi .. 765

warmed in gas flame—

10 to 15 Ohms less

Bast fiber

marked 675 cold

marked 680 cold

Reg 1 3
900 - 710 - 500

Test of 7 Bast fibres thick ends
Carbonized slowly 3 hours

560
460
500
510
460
460
510

Old lot.

No			
1	670 ohms	24	860
2	1000	25	470
3	[illegible]	26	520
4 —	729	27	770
5 -	1100	28	775
6 -	770	29	775
7 -	1070	30	480
8 -	660	31	530
9 -	770	32	520
10 -	1170	33	1000
11 -	750	34	800
12 -	1150	35	577
13	1100	36	430
14	910	37	2700
15	910	38	650
16	570	39	470
17	620	40	590
18	950	41	950
19	800	42	627
20	750	43	530
21	975	44	453
22	580	45	2500
23	810		

~~[illegible]~~

Experiment on 10 bamboo

Carbonized the old way [illegible]

of the [illegible]

taken from [illegible]

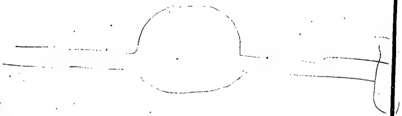
weighed [illegible]

Dr Moses

1- 1027 ✓
2- 970 ✓
3- 1100 ✓
4- 360
5- 725
6. 2000 ✓
7- 710
8. 975
9 620
10- 2100 ✓

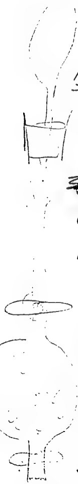
Carbonization of 10 bamboo
1 hours – taking 6 of
the lowest + [illegible]
[illegible]
[illegible]

1. 850
2. 600 – ✓
3. 710
4. 194 – ✓
5. 660 – ✓
6. [illegible]
7. 758
8. 650 – ✓
9. 570 – ✓
10. [illegible]0



Novemb 14 1880
TAE

Chas Batchelor



Vacuum by heating Carbonized material and Carbon in ~~glass~~ bulb—stop-cock at each end of Carbon bulb— one end open on other end lamp. Heat the carbon bulb with open end close end stop-cock and open one leading to lamp

Nov. 20, '80

Variations in resistance before & after placing on pumps.

Before 345 } 161
After 184

D. 508 } 317
D. 191

445 } 278
167

491 } 309
182

455 } 238
217

508 } 306
202

466 } 251
175

167
184
191
18[illegible]
175
202
217

Alex. [illegible]

Nov. 17th '80.

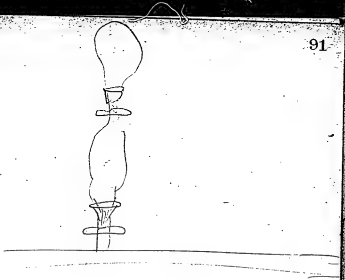
Experiment to determine difference in weight between high & low resistances:—

6 Bamboo carb old way, high test
Wt. = ,031.7 Gr. = 31 7/10 Milligrammes

6 Bamboo carb one from Low resistance
Wt. ,034 Gr. = 34 Milligrammes

The above were selected from out of ten of each class being the six (6) highest & 6 lowest resistance of their respective lots.—

Alex Welsh



Resistance compared with

Lamps	Ohms
500	365
505	357.5
510	350.5
525	330
549 1/4	300
595	250
649	200
713 3/4	150
493	375
476 1/4	400
446 1/2	450
420 1/2	500
397	~~600~~ 550
376	600
340	700
263	1000
330	730

16.7 : 16 ::

144

288 : 25 : : 16

18) 25 14 candles
18
70

10.8
138
864
108
116.64

18
18
144
18
324
116.6
4406 21
4
41) 40

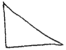
3738
3407

14 candles
16 candles

10.8
18.
288.8
9.6
19.2

21
19.2
1.8

125
43
16.7



17
17
119
17
289
64
353 187
1
28) 253
224
36) 2900

2.

14.581
21.311

3907)33000(8.44
31 248
175 20
156 28
18 9 20

7/3738
534
4272)33000(7.7
29734
33660

 Lamps

$6'' \times .017 \times .008$

Average 16.7/1000
Diameter 18.7/1000 2.

$6'' \times .017 \times .0108$

Average 19.2/1000
Diameter 21/1000 1.8

$.0125 \times .0125 \times 6''$

Average 16.7/1000
Diameter 17.8/1000 .9

Lamp .17
8

$\frac{2}{3} \times 25 = 16.7$

$\sqrt{17^2 + 8^2} = \sqrt{353} = 18.7$

$\sqrt{18 + 10.8} = \sqrt{440.6} = 21$

$\frac{2}{3} \times 28.8 = 19.2$

16.7 : 18.7

12.5
12.5
156.25 Diameter 17.6 Square
2
312.5

16.7 average

2 - 36 - 25
2 34 10
2 - 15

120
15
135

2 - 38
36 55
1 5

65

2 - 41 - 15
39 40
1 35

195
47

Pump 2

2 - 33 - 40 Spark Started

2 - 34 - 10 10 seconds of current

2 - 36 - 25 spark off

2 - 36 - 55 10 seconds of current

2 - 36 ——— 8

2 - 39 - 40 20 seconds

2 - ~~41~~ - 15

43 - 25
41 - 40
$\overline{\quad 1 \quad 45}$

105
52

2 — 41 — 40 20 seconds

2 - 43 — 25 8.0

2 - 45 - 30 8.0

2 — 46 30 sec

2 - 4[illegible] 2.0

2 — 48 — 20 30 sec

2 — 50 - 20

2 — 50 — 30 1 minute

2 - 53 — 45 [illegible]

Nov. 21st/80.

Experiment made to determine whether length of carbon in any way effected resistance,

Length	$2\frac{7}{16}$	$2\frac{15}{32}$	$2\frac{1}{2}$	$2\frac{17}{32}$	$2\frac{9}{16}$	$2\frac{19}{32}$
	462	443	620	710	670	365
	330	484	585	658	512	
	661	395	390	613	500	
		454	457	730		
		473	547	730		
		387	645	478		
		513	595	374		
		330	555	652		
			575	534		
			545			
	1453	3479	5514	5479	1682	365
G. Avg	484 1/3	434 7/8	551 2/5	608 7/9	560 2/3	365

Alex. Welch

Carbon loops

From this date we call the "regular loop" a Bast fibre cut 10 x 14 thousandths. Put on lamps of this kind "Regular" "Date" and Resistance

carᵈ 5 hour Chas Batchelor

11/26/80.

" Five @ hour Bake low to regular

- 397 – Brok
420 out
443 out
337 brok.
440 out
367
433 out
474 out
372 Brok.
446 out

Lot 8 17

375
376
398.
395
348 Vac. Sealed in
484 out.
377.

\# 3 Bamboo 3 hr.
1200 over
1200 "
1200 "
1200 "

\# 4 Bamboo 4 hr
1000 over
" "

Bake "Regular"

4 #1 Bamboo one @ hour heating very slow
1200 over
1200 "
1200 "
1200 "

\# 2 Do 2 hr Do.
1000 over
1000 "
1000 "

1.2.3&4 taken out of clamps

Lot 14 – Bast Car'd 8½ hrs Nov. 25/80.
606 Carbon'd 8½ hrs. – 7 hrs Black
661 hair, 1hr from Black to Bright red
453 ½ hr from B.R. to regular heat.
395
510 (Taken out)
481.

Nov, 26/80

Bamboo 10×17 5 Hours.
Brot up very gradually
375
396
413
358
385 all sealed in and sent up to Laby
375
348
386
404
368

Alex. Welsh

Nov. 27/80.

Bast 10×17 – 5 hrs.
292
315
296

1 Paper 9×17 – 5 hrs

about 850 sealed in and sent to Laby 11/29/80.

Lot of 19 "Regular" Bast
440
408
421 Taken out.
428
560
415
483
402
473
516
503
467
474
448
455

11/29/80.

Lot #3 ~ Bast fibre 10x17. Having no pith seams. 5 hr. Carb. for further reference see Van Cleve's Book p. 29.

— Resistance —

·285
·266
·260
·251
·289
·300
·307
·272
·257
·300

In Box

Alex. Welch

Lot #2 #0 11/29/80

. Bast 10x17 – 5hrs. (See Book (Bradley's) p. 28)

B. in Hand'g

Resistance ~ 268. 289. 262. 347. 317. 335. 307. 325. 314. 311. 325. 289. 284. 307. 293. 282. 278.

To be kept separate.

Alex. Welch

11/29. 80.

Lot #12

#1 Solid Bamboo cane (new stock) 8x17 – 5hrs

(See Bradley's Book p. 32)

Resistance — 344. 338. 324. 324. 330. 319 312

downstairs

Alex. Welch

Lot #1 #2 ~ 5 fibres 11/30/80

Bast (See Bradley's book p. 27)

Resistances — 290. 272. 250. 280. 288.

Alex. Welch

Lot #7 #3 11/30/80

Paper 9x17 (see Bradley's book p. 31)

745. 750. 699. 805. 720. 820. 702. 632. 781. 781

Alex. Welch

11/30/80

Lot #13 Bamboo 8x17 – cut from new stock. peculiar kind of Bamboo (See Bradley's book p 33)
This stock looks very good — 11 fibres
Resistances: – 377.347.352.395.382.336.359.337.
Alex Welsh

Lot of 19 – 11/30/80.
Bamboo 8x17 – 5 hrs. regular
Resistances: – 377.350.508.380.359.383.392.346.335.
390.378.345.340.383.353.
14
Alex Welsh

11/30/80
Lot of 18 – Bamboo 8x17 – 5 hrs regular
Resistances: – 487.445.438.436.404.439.485
405.492.481.481.447.435.435.493.
457.
Alex Welsh

H – 13 Pts 12/1/80.

Lot of 16 Bamboo 8x17 – 5 hrs.
Resis: 289.278.312.292.289.294.301.276.285
300.286.274.296. — O.K.
13
Alex Welsh

Dec 1st 1880

The lamps made for Laboratory from this date will be Bamboo – 8x17 thousandths – 5 hours carbonization – and will be numbered consecutively commencing at 1.
All will be under 400 ohms resistance when cold —
– Platinum Clamps. —
Chas Batchelor

#5 Dec 1st 1880 12/1/80.

7 Bamboo 8×17 – 6 hrs.

Resis's: – 290. 267. 280. 294. 261. 289. 275. 297. 313. 320. 307. 282. 309. 283. 272. 284

down stairs

Alex. Welch

Lot 18 – 18 fibres Dec 1st 1880 12/1/80.

#6 Bamboo one half size of original fibre made from the best of the Tall Bamboo (See Bradley's p. 37)

110. 164. 125. 85. 194 (1 9/32). 125. 138. 126. 110. (Cont'd p. 129.)

Alex Welch.

Dec 1st 12/1/80

#7. "Tapes." 5

Bamboo 8×17 small piece cut out of each 1/2 in away from the beginning of the round 1/4 in long reducing same to 14/1000.

See Bradley's book p. 37

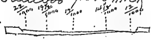
Resis = 358. 350. "Sealed in and sent to Lab'y".

Alex. Welch

Dec 1st 12/1/80

#8 5 – 5 hrs

5 Bamboo 8/1000 Thick Tapering Thus (See Book p. 39 Bdys)



Resis: – 309. 305. 313. 305. 318 (Sent to Lab'y)

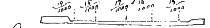
Alex. Welch

19 Bamboo 8×17 5 hrs.
Resis: 283. 295. 325. 257. 284. 360. 290.
296. 285. 281. 291. 295. 274. 260. 296

Alex. Welch

Dec: 2d 1880.

Tart Bamboo 8/1000 thick, Taper as follows:



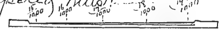
Resis:– 264. 270.

(Del. 12/2/80.)

Alex. Welch

Dec. 2d 1880.

3 Bamboos from stock same as last lot of same size & 8/1000 thick.
Tapered thus:



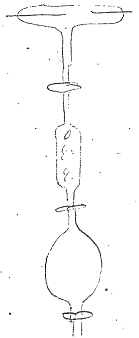
Resistance: 287. 289. 325.

Alex. Welch

Dec. 3d 1880.

Bamboo 8×17 – 35/1000 thick & 62½/1000 wide on ends from best of last lot – regular length. There is one of them 1/2/1000 small on one end.
Resis: 407. 305 267. ?61. ?61.

— See p. 125 —



Order

Make a mould full Req
Bamboo & horn req heat—

also mould full. same using
Iron mould and going up to
Safe final temperature—

The carbons are to be numbered
or called. Nickel Mould Req
and Iron Mould Req

They are to be tested for
Res cold & put in lamps.
& Res marked on each lamp

afterwards they are to have
their Res measured at 16 Candles
to determine if the heat ~~attainable~~
with Iron Mould ~~is sufficient~~.)
The final Res at 16 C of both lots shows
the measure of Iron higher than its Nickel.

3rd Quality
2d Grade

Dec. 7th '80. —

Bamboo fibre. This is the correct heading specially selecting to find out whether the dark streaks [illegible] & the wood being mouldy are not injurious to the fibre for carbonization purposes. (See Bradley's Book, p. 40)

1st — 284. 258. 240. 289. 252. 260. 276. 264. 27[illegible]. 260

2nd — 240. 246. 283 = Gen. Av. 263 10/13

2d 272. 255. 253. 270. 267. 270. 263. 261
256. 245. 259. 244. 257. 266. Gen'l Av. 262 1/7

[illegible]

Dec. 7th '80. —

Lot # — Bamboo [illegible] 10 × 17
5 fibres
(See Book Bradley's p. 30)

Results 292. 292. 280.

[illegible]

Dec. 7th '80

Lot #2 Bamboo 10 × 17 (See Bradley's p. 28)
7 fibres
Results: 285. 281. 265. 299. 265. 276 G.A. 27[illegible]

[illegible]

Dec 8th 80 —

Bamboo 8x1" skeleton selected from the best of the last lot of so called "Tree Bamboo"

Query:— "To determine whether there is any difference between the so called "root" and "the so called root-stocks".

"Would like to know all about this at the earliest possible moment"? See Bradley's bk p. 41

"Canary color very clear supposed to be the best"

For resistance see p. 133. —

[illegible]

Dec 8th 80 —

Bamboo 8x1" cut from new stock [illegible] stamping party — (See Bradley's book p. 42

Resist. 270. 267. 292. 286. 276. 267. 253. 286.
280? [illegible] 265?

[illegible]

Dec. 8/80.

Bamboo 2 sizes (cont'd of p. 117)

Lot recd. this day. Resis:- 195. 185. 165. 184. 171. 165. — Av. 178. Alex Welch

Dec. 9/80.

Bamboo 2 sizes (cont'd of above)

Resis: 102. 118. 110. 104. 118. 110. 104. 101 — Av. 105 5/8. Alex Welch

Dec. 9th 1880. —

Special lot of Japanese cont'd of p. 127

Resis: 256. 211. 221. 236. 212. 218. 222. 222. 224. 248. 213. 224. 223. 236. 231. 236. 236. 227. 209. 230. 236. 222.

Av. 227 3/22 Alex Welch.

Dec. 13/80

Rec'd of Mr. Edison's hands

1 (1) "Regular" 2 in R. 70

1 " 1/2 " " 60

Alex Welch

Dec. 8th 1880

Do not use any carbons "regular" hereafter of over 300 ohms resistance as directed by Mess. Edison & Batchelor this day. —

Alex. Welch

Dec. 9th 1880.

Directed by Mr. Edison to take out all bast carbons from inside parts as he does not want same.

Alex. Welch

Tauton [illegible] Decias (Sup. 127)

Acris

206	267	325
280	23[illegible]	285
327	21[illegible]	286
2[illegible]7	275	255
318	26[illegible]	305
288	239	286
27[illegible]	30[illegible]	315
308	231	331
300	272	331
265	23[illegible]	2719
200	278	
250	331	
27[illegible]	270	
28[illegible]	209	
218	293	
290	286	
288	327	
230	310	
292	278	
252	240	
27[illegible]	31[illegible]	
270	27[illegible]	
240	288	
265	288	
278	356	
27[illegible]	205	
23[illegible]	365	
236	312	
289		
329		
8161	8050	

Totals 8161
8050
2719

67) 18930 (282 $\frac{36}{67}$ [illegible]

Alex. Veitch

12/15/80

From this day all regular carbons are to be distinguished as follows. 9. 6m– 13 3– C 2. D 1½. by direction of Mr. Batchelor.

Alex Welsh

Jan. 4th '81.—

Bamboo "Reg" ½ size treated with carbolic acid under cover of box.— (3 hr. heat)

Resis.: 256. 254. 254. 460. 245. 245. 245

218. 218. 218. 190.

Alex. Welsh

—— " —— Jan. 1 '81. ——

Resis. of Bamboo "Regulars" carbonized in Ashes.

566. 675. 570. 384. 390. 589. 589. 730. 604

604. 685. 628. 760. 760. 368. 441. 417.

377. 412. 369. 510 } 635.

Alex. Welsh

Jan. 1/81. –

A "Regular" carbon for the present is a fibre carbonized for 3 hrs. without stop made of Bamboo 8x17. –

Alex. Welsh

Jan. 5/81 –

Platinized loops.

Resis: 570. 825. 640. & 690

Alex. Welsh

"A" Jan. 5/81. –

Bamboo 8x17 – 3 hrs. heat – Treated with carbolic acid under cover of iron box. Nine minutes stop.

Resis:~ 570. 500. 510. 426. 430. 426. 445. 443. 570. 525. 443. 500. 500 & 500

Alex Welsh

Jan. 5/81. –

Bamboo "A" treated with ashes regular heat 3 hrs. no stop.

Resis: 330. 375. 261. 261. 260. 268. 267. 265. 260. 267. 294. 245. 289

Alex. Welsh

Jan. 6/81

Reg. "B" Carbons treated with carbolic acid under cover of iron box

Resis: 256. 254. 254. 245. 245. 245. 218. 218. 218. 190.

Alex. Welsh

1/7/81

No. 6 Shellac lee Lawson

2 Reg. "A" 4 hrs. 8x17 Resis under 300

Alex Welsh

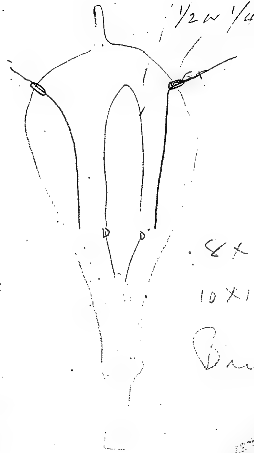
1/8/81.

1. 4 New style clamps. Carbons "reg" below 300.
1/6/81. 3 P.M. placed in circuit
1/7/81. 10 P.M. Taken out. A.K.

2 3 Do. " " " 300
1/8/81. Placed in solution 11:30 am
1/10/81 Taken out 9 - 1/8/81. Alex Welsh

Experiments in clamping platina wires to carbon by means of electric deposition. The leading wires the leading wires as far as the carbon tips ought to be cleaned by means of heat before being sealed in lamps

Alex Welsh.



1/2 or 1/4 from [illegible]

8 x 17

10 x 17

B[illegible]

Lot # 3 1/18/81.

New style clamping.

1/16/81. Placed in solution 8 P.M.

1/17/81. Taken out 1:30 P.M.

Alex Welch
1/18/81.

Lot # 4 - 1 Spiral Cu
" 5 - 7 B's Ag. Alex Welch
1/19/81.

Lot # 6 - 4 "B's" Cu Bk. 1 p. 11
7 - 1 - Spiral "G" " " 1 " (20)
9 - 1 - " " " " 1. (20)
8 - (6) "B. Ag.
10 - (4) " Cu (Both taking Cu metal - See Lawson) } " 1 p. 12

1/19/81. All new style clamping to be heated at about 175°F 1/2 hour to dry same. Lawson

2 A's Plat'd Loops Ro. 1/19/81
See Lawson's book! p.3

11. 1 Spiral Cu. Bk. 1 p. 12 1/20/81.

12 - 5 B. ag } Bk. 1 p. 13 1/20/81.
13 - 4 " Cu

1/19/81.
Order No. 46 – 12 – Car. R. 299.334.312.300.
299.289.283.285.308
283.325 – G.A. 303 4/11

" " 105 – 5 Car. R. 337.328.323.325 & 278

" No. 45 – 10 Car. R. 267.254.233.262.293.290
278.282.296.299 – 275 2/5

" " 107 – 8 Car. R. 426.429.469.462.500

1/21/81 " " No. 43.7. Car "A". R. 302.267.296.274.289.299.
267

" " 115.8. Car "A". R 334.350.350 – 325 – 365
340, 352, 337

" " 123 11 " "A" R 295 – 312 – 312 – 300
295 – 290 – 315 – 310
305 – 300 – 305

" " 44.13 " "A".R. 300 – 310 – 290 – 280
275 – 270 – 285 – 295
280 – 285 – 275 – 300
295.

1/22/81
" " 124.15 " "A".R. 245 – 290 – 250 – 255
280 – 245 – 250 – 255
275 – 255 – 240 – 230.
260 – 275 – 280

" " 125 5 " A.R 350.330.355.360.350

" " 120 1 " "A" R 480

" " 139 7 " A.R 175 – 182 – 230 – 210 – 185
190 – 210

1/22/81 in double clamps

Order No 117- 4 bar R 120-125-120-120.

1/24/81

Order No " 126-3 bar R 300-285-290

" " " 127- 2 bar R 410-480

" " " 44- 6 bar R 290-230-250-280 245-275.

" " " 47- 5 bar R 235-225-210-225-225

" " " 48- 8 bar R 270-275-300-270 280-290-285-275

1/25/81

Order No 128-9 bar R 260-255-250-255- 270-~~13~~125-120-120-130

" " 32-13 bar R 315-310-275-280 295-260-270-290-290 290-295-280 295.

" " 126-2 bar R 290-256

" " 32-14 bar R 275-265-315-290 288-290-295-275-310 295-290-280-285-280

" " 131- 5 bar R 405-385-370-380-375

" " 133- 6 bar R 340-325-310-230 300-295

1/25/81

Order No 133. 14 bar R. 565-520-525-670 730-735-700-725 590-590-565-600 590-620.

Order No 138 6 bar R 300-295-285-290 315-300.

" " 137 4 bar R 310-360-340-345

1/26/81

" " 139 6 bar R 410-420-400-450-440-415

" " 143 5 bar R 410-420-390-375-410

" " 144 5 bar R 310-340-305-330-290

" " 144 13 bar R 270-290-250-270 260-295-230-275 290-285-225-240 230.

1/27/81

" " 132 15 bar R 220-208-245-210-220 255-210-270-250-210 230-250-270-245-270.

1/28/81

" " 153 33 bar R 120-125-115-120-135-125- 135-120-115-120-130-120-115 145-125-120-125-135-120-115 125-120-130-110-130-125-115 110-130-120-120-115-125.

1/31/81

Order No 140 R 12a

245-255-230-235-270
250-260-255-240-270
260-250.

Order No 141 R 6a

245-240-245-240
245-240.

Order No 39 R 10a

295-290-310-325-285
296-325-305-325-335

Order No 40 R 13a

380-350-315-310.325.320
310-340-325.330.345.360
345.

Order No 145 R 2a

325-300

Order No 141 R 7a

285-300-295-285-295-295
280

Order No 133 R 12a

250-270-260-255-250
220-235-240-260-270
240-270.

Feb 1/81

Order No 37 12 car

200-200-230-235-200
225-230-205-200-230
205-195

Feb 1/81

Order No 156 9 car

376-380-390-350-365
410-340-385-400

" " 146 10 car

265-280-280-260-270
275-280-275-265-290

" " 133 13 car

168-175-170-195-180-180
170-225-195-205-185-180
215

Feb 2/81

Order No 166 3 car R

155-150-150-175-155-155
150-170-150-150-160-165-150
170-145-162-130-135-152-165
170-165-160-165-160-168-175
170-165-160-165-150-160-155-165
165-175-165-150-160-140-145

" " 166 26 car R

195-170-185-180-175-170
165-160-175-165-190-180
175-155-170-165-150-165
175-175-160-195-170-180
165-150.

" " 156 13A car R

545-520-485-550-445
570-410-575-445-570
510-490-475

" " 156 17A car R

480-520-545-440-550-500
500-520-542-420-445-420
360-400-475

" " 35 13A car R

350-345-360-210-190
335-315-325-325-340
315-315-325

Feb 2/81

Order No 35. 5A. R
265-245-235-230-215

" " 33 11A R
240-235-245-220-195-230
235-195-235-215-230

" " 33 11A R
195-205-200-205-195
225-195-210-180-195
190

Feb 3/81

Order No 36 12 A bar
235-240-230-245-240
230-245-245-230-220
240-245.

" " 33 9A bar
205-205-200-200-210
205-200-205-200

" " 35 7A bar
325-315-330-325-335
310-305

" " 192 11A bar
200-210-205-200
210-195-195-205
200-215-205.

" " 39 10 bar
225-230-240-235
205-245-245-225
210-255-192.

" " 192 4 bar
210-215-195-200

Feb 3/81

Order No 39 R 2 bar
270-275

" " 40 13 bar R
235-220-240-230-249
230-230-225-230-245
235-230-220.

" " 33 4 bar R
215-190-225-220

" " 39 7 bar R
248-245-195-256-245
240-245.

" " 192 5 bar R
205-200-236-205-205

" " 1-92 20 bar R
350-350-350-335-340
350-365-345-385-360
350-355-365-345-360
355-340-365-350-355

" " 192 16 bar R
300-305-320-345-330
325-320-315-330-340
330-325-340-345-360
355

Feb 7/81

" " 198 R 15 bar
540-612-580-560-600-585-550-490
565-550-615-590-560-575-585

" " 192 R 15 bar
670-900-1000-820-650-825-650-710
685-670-1000-950-700-650-850.

" " 192 R 16 bar
280-260-245-255-730-295
260-285-265-230-260-290
280-267-260-280.

Feb 7/81

Order No 1981 7 car R

600-590-570-585-560
565-575-550-560-590
710-720-705-730-650
675-670.

" " 198 14 car R

395-380-800-430-450-445
435-730-430-460-550
575-560-576.

" " 198 14 car R

650-370-410-500-420
460-475-550-570-585
Order 610-630-620-605

Total result of car various tested 711.

March 24. 1881,

Cost Pt. wires

1 lb 3 dwt cost $ 94.94

Express charge 7.80

$102.74

It made 12,000)10274

2 (~~12000~~ 6000) 102.74 (1

1.7 cts per lamp

J R Upton

Nov 27, 1880

Tested No 1 Bamboo carbon in Iron clamp, and afterward in Platinum clamp and found no difference in resistance.

Tested No 1 Bamboo carbon in Nickel clamp, and afterward in Platinum clamp and found no difference in resist.

We find that carbons that have been tested and allowed to stand a few days always test higher. The difference in resist we think is the result of atmospheric action on carbon.

H. A. Hills

Order 1/24/81

135 Lamps with platinum clamps and plated carbons.

136 Lamps with platinum clamps and unplated carbons.

158 Lamps with silver clamps and unplated carbons

Lot of 17 Regulars

Resistances in full of different Lots "A"

Lot No	1			2			3		
1881 Jany	12			12			12		
	Cold	Hot	Remarks	Cold	Hot	Remarks			
	249			377			341		
	319			354			402		
	285			297			418		
	332			315			283		
	294			336			300		
	293			414			304		
	291			366			329		
	377			391			218		
	336			372			259		
	254			376			293		
	282			273			331		
	292			378			251		
	303			296			305		
	340		300 [illegible]	382		349 [illegible]	209		
							216		
							236		
							208		285 [illegible]

1881.

Lot No	1			2			3			Lot No. 29					
Jan'y	12														
	Cold	Wet	Remarks												
	249			377			341			329			341		
	319			354			402			285			365		
	285			297			418			267			329		331 1/2
	332			315			283			302					
	294			336			300			343					
	293			414			304			336					
	291			366			329			329					
	377			391			218			344					
	336			372			259			303					
	254			376			293			350					
	282			273			331			360					
	292			378			257			363					
	303			296			306			336					
	340		[illegible]	382			209			343					
				312		349 4/15	216			311					
							236			362					
							208		255 11/17	303					
										394					
										380					
										359					
										302					

4	5	6	7	8
297	270	311	232	251
241	327	297	245	325
260	302	254	250	339
245	322	293	213	266
196	299	283	213	233
237	260	281	209	263
261	329	280	227	265
217	248	240	229	257
234	276	264	291	289
203	293	262	232	257
251	322	318	245	244
217	305	246	212	269
205	349	265	241	232
207		294	208	275
240		268	205	259
201		278	240	277
				233
				253

9	10	11	Mis.s lot	12
243	255	278	289	232
272	270	306	291	316
289	288	331	270	245
245	259	327	267	245
292	331	397	289	227
309	240	365	267	268
262	250	304	256	223
295	267	349	221	268
238	323	326	267	229
295	251	336		259
249	244	324		239
264	267	310		244
336	223	317		260
291	251	339		289
255	250	299		259
348	242			220
260	275			246
	288			236
				248

13	14	15	16	17
232	289	261	224	358
241	260	225	268	357
232	277	226	276	343
263	239	267	261	403
223	277	199	235	362
257	259	257	255	381
245	242	263	265	374
280	234	264	259	338
236	241	250	257	491
254	219	224	264	327
312	223	204	240	420
346	236	196	243	427
267		294	249	360
			265	420
			243	

18	19	20	Total 21 As	21
344	316	350	535	331
327	311	358	635	378
322	327	377	625	306
339	366	393	790	343
385	347	418	248	346
346	339	359	724	392
342	358	374	764	337
361		416	226	365
310		403	706	373
405		463	658	388
296		337	775	280
388		398	690	365
423		391	234	395
299		395	766	371
334		360	354	376
283		350	379	392
			615	
			207	
			514	
			251	

22	23	24	25	26
335	294	441	280	326
329	304	383	296	312
300	279	387	280	318
335	304	362	298	332
369	317	387	288	426
403	315	481	279	310
332	312	481	249	291
344	323	434	248	310
330	283	464	325	260
299	317	520	301	365
350	309	372	278	335
337	316	380	280	335
294	303	418	243	293
291		428	248	311
		431	251	295
				266

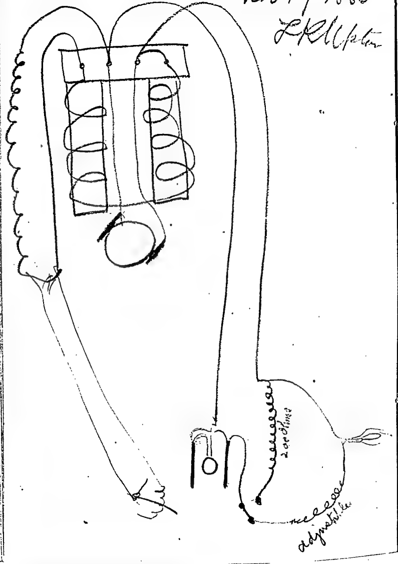
27	28	29	30	31
426	443	358	270	241
417	376	261	274	251
381	408	262	299	252
384	284	232	256	227
411	393	363	272	256
339	410	236	222	236
381	248	261	236	213
376	405	234	267	223
380	435	214	254	227
365	290	362	244	234
510	491	206	259	227
382	373	249	271	
363	431	245	256	
443	443	242	232	
360	349		264	
639	372		297	
			232	
357	391	237 [illegible]	219 9/17	235

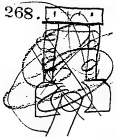
32		33	34	1(a)	5
218		380	325	29.9	214
215		230	244	300	223
232		242	331	286	211
191		209	252	320	222
236		267	265	323	206
233		256	265	299	209
238		278	294	289	218
209		261	332	312	241
267		213	241		216
198		256	261		216
278		289	249		200
209	225 3½	227	319		230
		241	282		200
		236	246		202
			289		209
			273		218
			234		218
					210

7	306	278	272	290	269	299	261	265	283	289	277	270	267	231	258	278
6	349	227	245	218	210	230	264	200	223	238	238	263	209	245	225	264

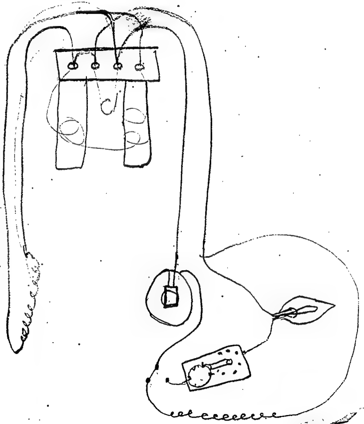
Nov 17 1880

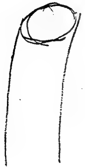
F R Upton





Nov 17 1880
F.R. Upton





$$\begin{array}{r} 1000 \\ 127 \\ \hline 883 \end{array}$$

~~127~~

117

$$\begin{array}{r} 117 \\ \hline 7024 \end{array}$$

117 : 883 : 1000 : x

117 | 88300 | 754

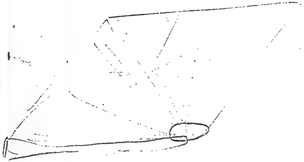
$$\begin{array}{r} 88300 \\ 819 \\ \hline 640 \\ 585 \\ \hline 550 \end{array}$$

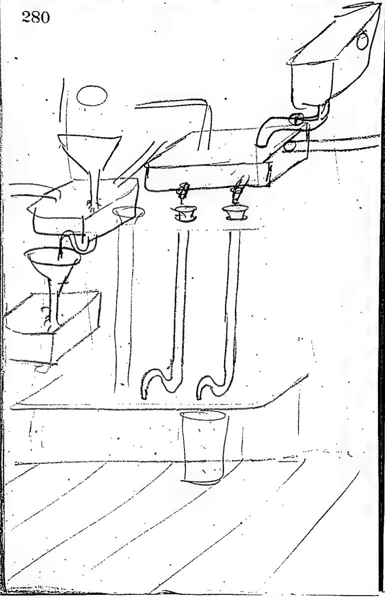
$$\begin{array}{r} 1000 \\ 117 \\ \hline 883 \end{array}$$

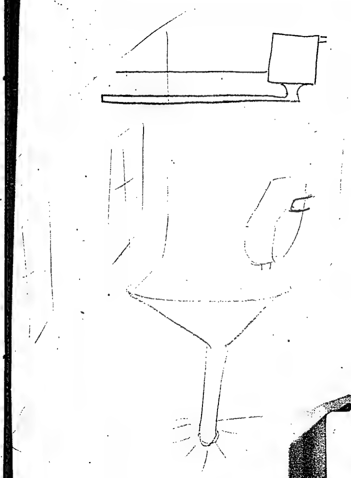
117 : 883 : 100 :

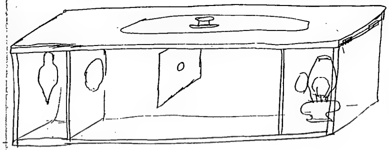
117 | 8830 | 75

$$\begin{array}{r} 8830 \\ 819 \\ \hline 640 \\ 585 \\ \hline 55 \end{array}$$





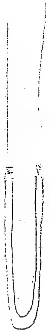


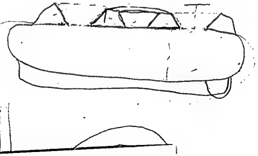


Menlo Park Notebook #107 [N-80-04-02]

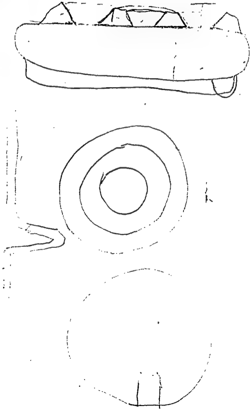
The entries in this notebook contain only the month and the day. The book probably covers the period April 1880-January 1881. Its author is unknown. Included are notes relating to tests of insulating materials, primarily glass, quartz, and calcite; notes on magnetism experiments; and notes on chemical experiments. There are also a few drawings of circuits. The label on the front cover is marked "107" and "Apr 1880." The pages are unnumbered, and the book has been used in both directions. Approximately 100 pages have been used.

apr 1880?





apr 1880?



Times, 2 min charging
1 " discharge

Max. of each, dis. read — Lead Electrode

(1) Glass = Green plate
(2) " = White "
(3) " = Window glass
(4) " = Guttapercha
(5) " = Gold
6 " = Polariscope

Quartz = 13. 2) 1 = Eyepiece

Opt @ 5 rt = +5

Recedes very fast after reading Gray in case of Q(1)

Elec. Obs. Dec. 4

Diel	1st Time	2nd "	3rd "	
Q 1/3 (1)	-85	-70	-55	Elec + .22
"	-40	-65	-47	" + .15
	-21	-38	-16	" + 28 1st contact longer
Glass (2)	-35	-30	-15	+20
	-38	-33	-31	+30
	-42	-44	-30	+28
Glass (3)	-40	-33		+20
	-45	-33		+20
" (5)	-30.	-24		+18
Q(2)	-62	-40		+16
	-35	-29		+12
Q(1)	-43	-28		+40

The residual discharge of Qtz – [illegible], [illegible], [illegible]

Glass as before

Ch 2 Min

Interval 30 seconds.

Plates in [illegible] over [illegible] Sol, disch. very faint.

Ch. about the same. That can be attained

Shot up to 60, [illegible] back & they reached 50

Dec 8

	1	2	
Qtz. (1)	40.	20	+ 30
	45	20	+ 30
Glass do	220	60	–
	160	50	– 15
	115	85	– 30
Selenite (1)	45	38	– 30
	85	55	– 22
	72	40	– 30
Glass Sensitized			
	35	30	
	~~50~~ 4	35	
	110	60.	
Qtz "	55	57	[illegible]
	130	–	

Res. Sech. Corp

— April 2 —

Process.

Battery 6. Leyden Jars —
Charged 3 sparks. — { Hanns Knit Jar [illegible]
after 20 Seconds, }
momentary charge of plate, then discharge
contact with [illegible] five
seconds, — Electrometer [illegible] after 10 Sec
& total, —

No	10 Sec	Total.		
1	80.	80.	?	
2	100, —	—	—	? —
3	35	35	—	—
4	38	40	—	(No discharge
5	— 73	—	—	— !!!
6	170	24	—	—
7	— 78	— 18	—	—

5 Sparks

No.	10 Sec.	Total	
1	75	75	No Increase
2 l	-40	-40	
3	+58	—	
4	-25	—	

5 Sec. Contact

r + 155, — leakage
l - 64 —
l - 135 —

10 Sec Interval, 5 Sec Contact

r + 60
r + 99
l - 82
l - 78
r + 55
r —

~~After~~ 15 Sec. Interval, 10 Sec Contact, — Opt. +.4

10 Sec — Increases !!!

r	35	63.
l	110.	130
r	80	85

Handle, — already on r or l,

r Total 115
l — 70 — (Induction defl to +70
r Defl. scale —
l, 111 — (Ind. defl to -65
l 135 (" " +100
l 50 " " +120

Same — but 50 — -36 = Total
l — -70
r +90
r +175

l 140
r 119
l 155.
r 130
174
r 177
l 176
r 181
l 165

Same. — viz. —

l 173

Apr. 7 —

Glass(a) —
Intervals, 5 sec, contact
5 sec earth
5 sec insulated
then Electrometer

Wind NW,
Charge =
2 Sparks

+111
+151
+140
−153

−191
−190
+195
+165
+185

Battery wire discharged by Wheeler

+174
−180
+176
−182
+170

This reverse charge in Quartz [illegible] [illegible] [illegible] the [illegible] [illegible] grows slowly — only reaches a maximum deflect. about 1 minute, —

Quartz <u>as</u> Apr 7.

Same conditions as last page

− 60#	Handle of Commutator  in direction which gives + Charge in Glass!!! —
− 58	
− 65.	
+ 78	Handle of C, ~~as for~~ to give — charge in Glass.
+ 74	"
+ 65	

Glass — repeated —— Handle same as in last exp with Quartz —

∓ 180	
− 189	
− 178	
+ 188	Handle as in 1st Quartz
+ 190	
+ 186	

Calcite (a.

− 40	Handle same as in
− 50	hands Exp with glass
− 43	Other conditions the same
+ 40	Handle same as in 1st
+ 44	Exp with glass
+ 43	

!!!

Expts on time, new charge

5 sec contacts = −150 5 p.m. handle up !!

10 sec " = 0 — —

12 — —

5 sec = — —

This source of [illegible] proved to lie in the [illegible] of one of the insulators of the apparatus ——

The instrument was modified so that [illegible] [illegible] [illegible] and this source of error ~~eliminated~~ disappeared.

Opt – 4 Apr. 8. —

Glass and Calcite give as yesterday opposite deflections

Calcite

5 Sec. Contact
- −142
- −139
- −143

10 Sec. contact
(1) left the scale!
(2) stopped after 220 pump
[illegible] – a very [illegible].
(3) left the scale!

2 Sec. Contact,
- −124
- −104
- −79
- −113
- −102

2 sec Contact
- −68
- −50
- −71
- −74

Apr 9

New arrangement, of Apparatus

1) Glass cas,

5 Seconds Contact: Off scale !!

3 Seconds " , Off scale,

2 Seconds " Off scale.

1 Second " + 200.

+ Off

+ Off

Quartz. 5 Seconds, + 9.5

+ 21.

+ 35

+ 41

+ [illegible]

+ 40.

+ 32

+ 60

Calcite (k)

5 Seconds, — — 3.0

0,

14.0

+ 0,

0.

+ 0,

10 Seconds

No Effect, —

No Effect,

30 Seconds

No Effect, —

Glass repeated —

5 Seconds — Off Scale

30 " "

Quartz (k) -

Calcite &c. to Sparks.

perfect
Electrometer [illegible] caused by many interferences — and mere change of gas — blistering — gave same results — Frequent [illegible] of glass and Calcite showed that all was in order.

After 7

Glass and Sponge [illegible]

Glass – 5 Seconds. – Off Scale

[illegible] Seconds + [illegible]

+ 183

+ 193

+ 205

– 187

Sponge – 3 seconds + [illegible] 0 [illegible]

– [illegible]

– 4

+ [illegible]

10 Second,

+

+ [illegible]

+ 20

+ 10

30 sec. + 27

+ 26

+

+87 Opt +4

+91

+85

= +89

Seconds. +79

+

+

Glass [illegible]

3^{12} +

[illegible] (b)

+45

+40

+42

[illegible] = 40

[illegible]

5 Seconds — Off Scale —

1 Second — Off Scale —

Glass had been previously washed and held in Bunsen flame to deprive it of all electricity. —

— Apr 12 1880 —

Glass.

30 seconds contact – 5 seconds to earth. — Off Scale =

20 seconds. — Off Scale —

Electrometer made less sensitive —

3.0 seconds interval = + 196
+ 204
+ 202 = 199.98
+ 197
+ 200

Quartz

± ~~+~~ 24
+ 37
+ 36 34.20
+ 35
+ 39

Calcite (a) + 4.
+ 2.
+ 3.
+ 2.5
+ 2.0

Calcite (b)

+ 4.5
+ 5.0
+ 4.5
+ 4.5
+ 5.0

Quartz b. + 40

Glass — 180 —

Glass (b.) (not washed nor heated) clean - never before used. — 185

Apr 13 1880

Quartz (b) 0 pt — 10

30 seconds to ...

+ 23
+ 40
+
+ 65
+ 64

Glass — (b)

30 seconds. — + 225
+ 225

Glass a
30 sec — Off scale —
$-10 = 0$ pt
20 seconds. — $+199$

$+123$
$+126$
$+118$

Quartz. — (a)
20 seconds. — = $+16.$
$+18.$
$+18.$

Calcite (a) $-9 = 0$ pt
20 seconds -9
Without Charging — -10

Charging -9
$-8.$
$-8.$ —

-9
-10
-9
-9

Plates in desiccator over night.

Apr. 14

Glass.
10 seconds $+149$
$+146$
$+149$

Quartz
10 seconds. —
$+ \cancel{100}$ 15.
$+ \cancel{125}$ 15
$+17$

Calcite $+9$
$+7.$
$+7$

Glass repeated.
— 8 —
$+150$
$+146$
$+140$
$+145$

Apr 22

Glass (1) — 30 Seconds contact.

= 166.5
154.5 = 163.2
168.5

Quarz (1)
25.5
18.5 = 22.9
24.5

Calcite (1) No Effect

Quarz (2)
22.5
17.5 = 20.5
21.5

Calcite (2) No Effect

Glass (2)
162.5
175.5 = 169.5
170.5

Glass = 100.0 pret

Quarz (1) = 13.1

Quarz (2) = 12.3

Calcite (1) No Effect —

" (2) No Effect. —

May 1. —
Charge 1 Spark. —

5 Seconds	Glass (1)	137 129. 133	133
	Quarz (1)	13. 13. 13,	
	Calcite. (1)	1. 1. 0.	
10 Seconds	Glass (1)	199 180 189	
	Quarz. (1)	,21. .22 ,25	
	Calcite	0 0	

20 Seconds	Glass (1)	225 220 230
	Quarz (1)	34 35 34
	Calcite (1)	+ 2 + 1 0

2. Sparks

20 Seconds	Calcite (1)	2 $+\cancel{0}$ 0
	Quarz (1)	+ 50
	Selen. [illegible] (3) Selenite (1) " (2)	[illegible]35 170 130

Spectacle —	20 Led		1ff
	10	"	225 —
Lense.	10	"	75 —
	20,		140
Glass plate	10		270
(H) Quarz "	10		20

Quarz lense — [illegible] 15-20

Mica plate, — Larger = 80 —

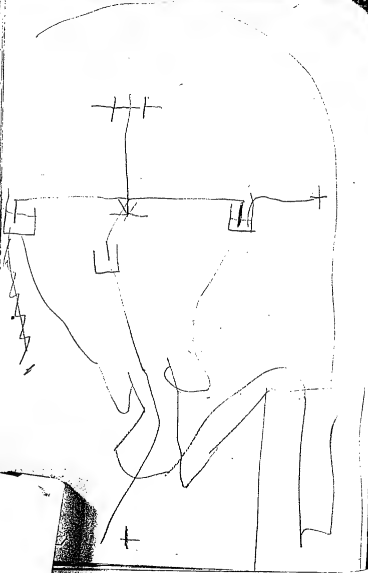
May 12

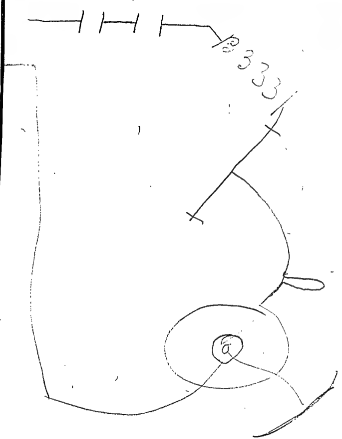
Series — Commercial Solution

4.15, — 22°. — Top Mark

4.45, — 22° 1.6 mm

Time	Temp	Merc.	Diff.	Room
4.15	22°			
4.45	22°	~~341.1~~	36.9	24.5
5.25	17°	304.2		23.75

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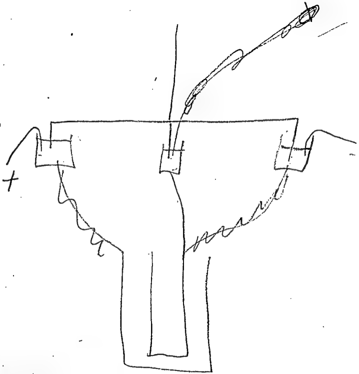
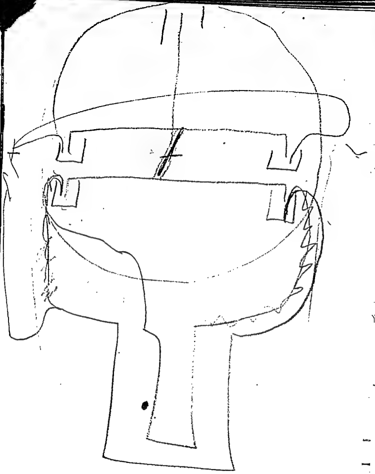
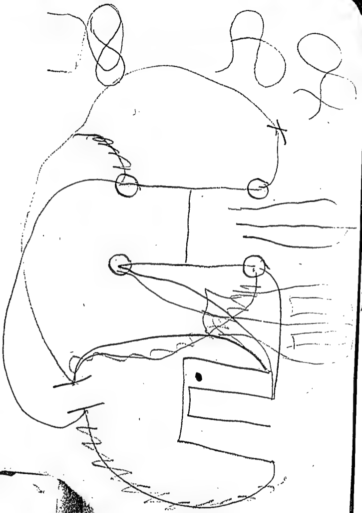
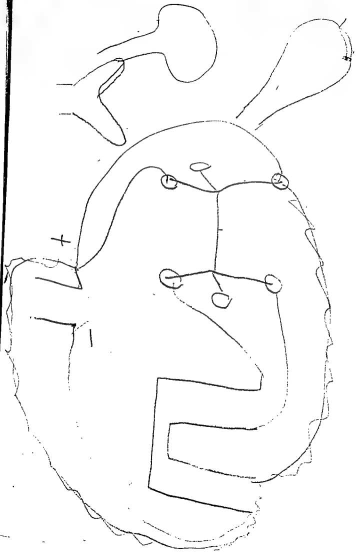
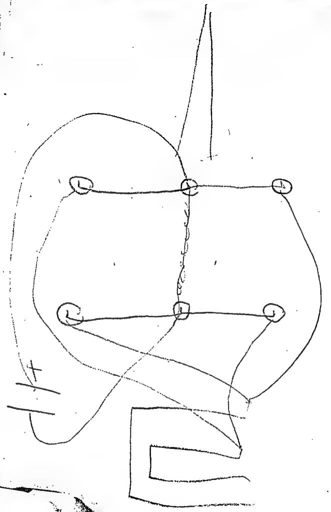
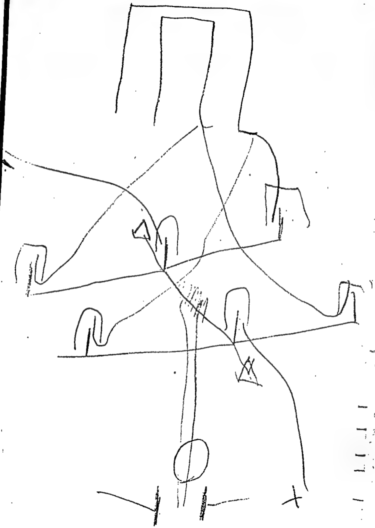


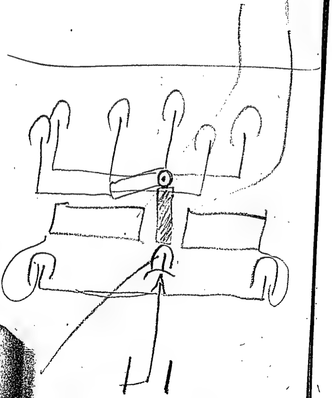


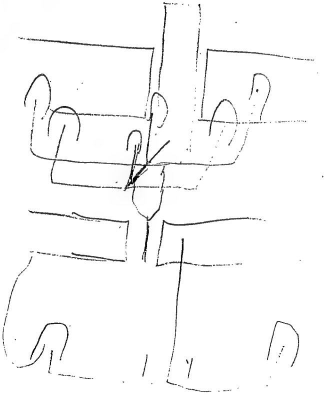


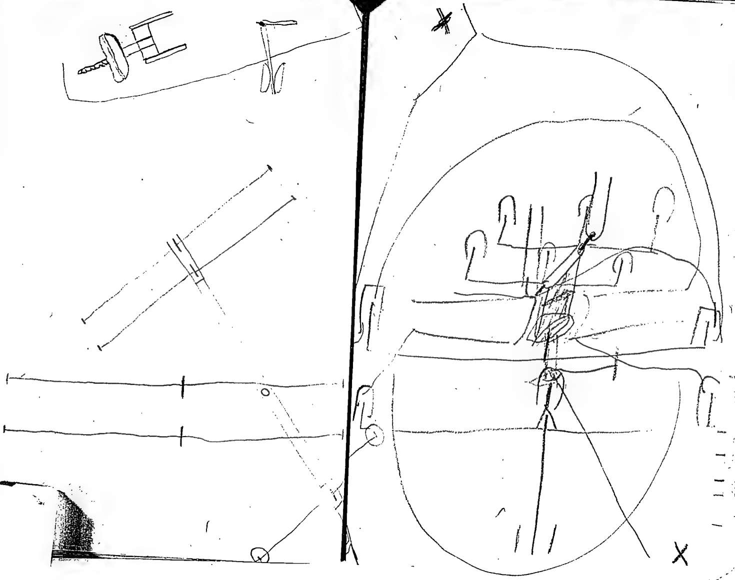


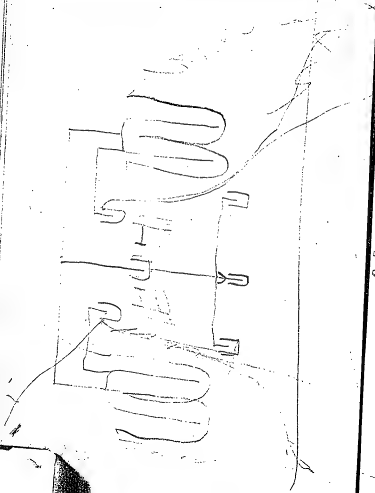


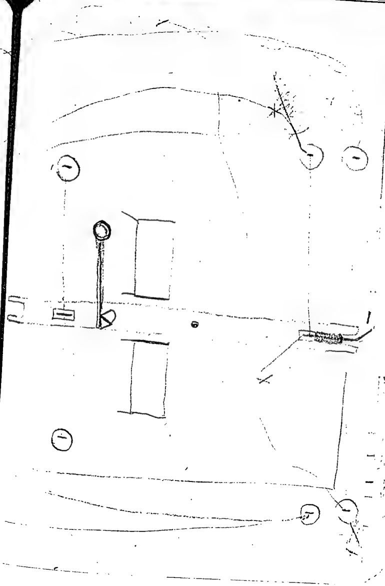


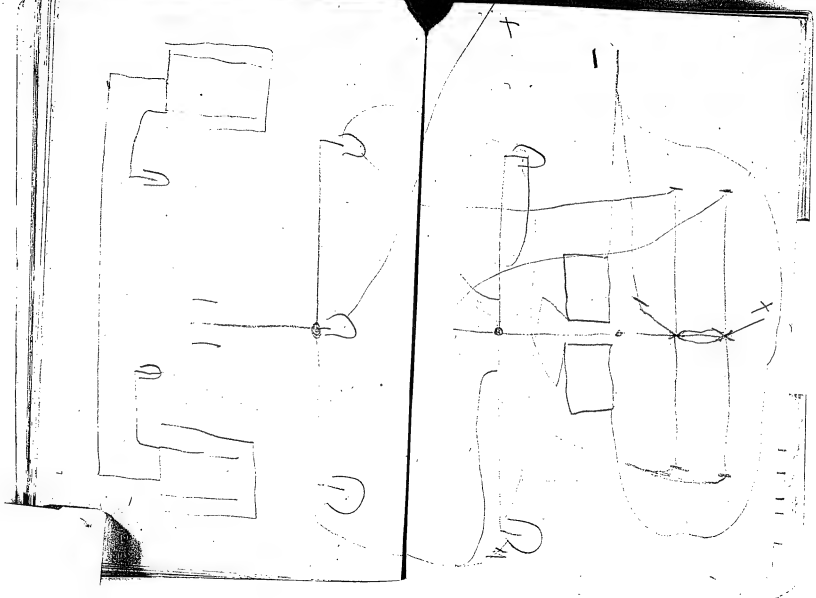


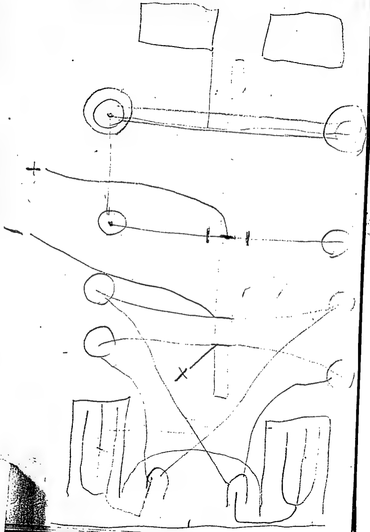


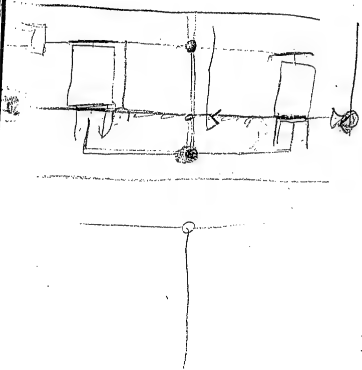


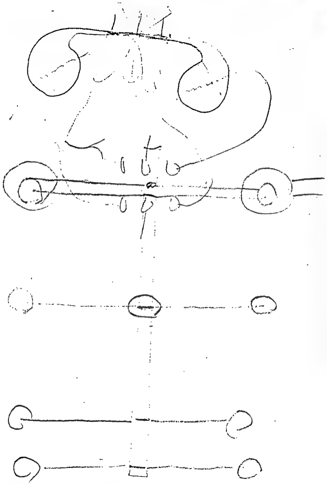


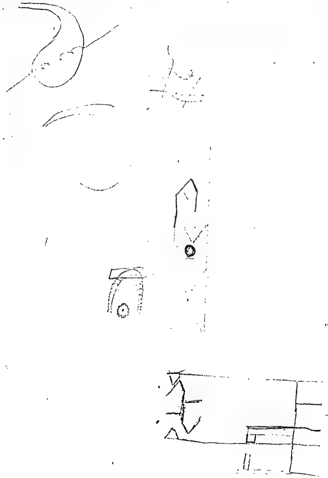












C

C

(1) 23,85 — before
23.25

.60

(2) 23,90 after
23.35

.55

(3) 23.95
23.20

.75

(1) 4,28
5 6 0

1.32

4

#

	log sin.	sin defl
Sin Defl.	7°0' = 9.0858945	0.12187
	6°7' = 9.0283865	0.10687
	6°3' = 9.0240157	0.10569
	6°0 = 9.0192346	0.10453
	6°0 = 9.0192346	0.10453
	5°36' 30" = 8.9913020	.098016

Times are .15 min. + 20, 45 + 19.0

+ 24 + 25

(1) 0.25 hours

(2) 21.0

(3) 40 0

(4) 64,0

(5) 89.0

90.0

Ld of iron in Mag. field

Magnet No 1 3 in. 1/2 in.

Magnetized Dec 20, @ 6,15

Tested on Rowland's Sin Gal.

			Defl #
Dec	20	630 PM	7°0'
"	21	315 "	6°7'
"	22	11.15 AM	6°3'
"	23	11 15 "	6°0'
"	24	12 15 "	6°0'
"	24	3 15 "	5°39', 5°39
"	"	"	5°34, 5°34 = 5°36' 30

[illegible]

Temp about 12°C

Amt Iron Filings less than 100 Gr.

Dec 25 — Infl. of hot water

Magnet II. Same size magnetized at same time & neither [illegible] as I. gives on being placed on [illegible] Gal. (Ben. [illegible])

11. 35 A.M. 6° 6'
6° 6'

Exposed for 10 min to boiling ~~water~~. —

log m = 8.8507572   m = .07091

Dec 25 — Xmas

10 30 A.M. 5.° 39'
5° 39'

Magnet inserted in same test tube with Hg & water — & placed for several minutes in a beaker of boiling water to test heating effect. — Hg, — slightly warm to touch after taking out. Magnet replaced afterwards gave

11. 15 A.M. — 5° 39'
5° 40'

Exposed to boiling water for a few hours gave —

log m = 8.9431743   5° 2'
m = .087735 (1)   5° 2'

Boiled for 10 min gave 4° 5'
(2)   4° 5'

Opt. 179° 54'

Dec 25, Opt. reset —

Magnets (2) set in position

Reads, at, 2.30 PM.

— — 6° 12'
6° 12'

Dec 25 1. PM. 6° 13'
6° 14'

Dec 26. 10.30 6° 11'
6° 12'

" 3.30 6° 8'
6° 9'

4.30 6° 9'
6° 9' } 6° 9'
6° 9'

1

lin's 1080

9.033 47212

430 to Six. —
Init action No change

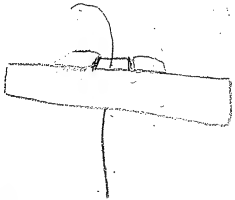
Dec 27	12 M.	6° 5'
	28 1 PM	6° 0'
Dec 28	1 PM.	6° 0°
		6° 0
" 29	12 PM.	5° 57' 30
Monday – 29	1.30	5° 58'

After digesting with HCl.

	4 PM.	6° 3'

After Aqua Regia 6°

Dec 31	11.40 AM	5° 58'
		5° 58'
~~Jan~~ 7	1 PM	6° 4'
		6° 4'



Action of Magnet on Light.

The light introduced into field + to lines of magnetic induction

For Faradays Glass Coef = 1.

CS_2 = .74

$ZnCl_2$ = .77

Flint Glass = .53

See Verdet & C. Neumann

Infl of Temp on Magnet I

Jan 8. –

4 P.M.

Defl	Temp
2° 49′	26°.9
2° 49′	34°.4
2° 49′	47°.7
2° 40′	63°.8
2° 24′	83°.0
2 28	— on Cooling
2° 45	(Shifted)
2° 40	98°

Supersaturation of Vapor

H_2O over paraffine —

Heated to about 110° —

Time over in [illegible]

paint cork —

[illegible] slowly — [illegible]

[illegible] without any disturbance

Jan 27 Supersaturation of CS_2 vapor over H_2O.

dest. water — [illegible] out — cooled to 40°. CS_2 introduced in bent tube water raised to 56° CS_2 then suddenly vaporized

filling the tube. — allowed to cool, — contracted slowly to 43.5° then noticeably faster at 43.0 vapor half gone. — condensing on sides of tube forming drops which cling to glass & in two instances allow H_2O level to rise over them a 42° vapor nearly gone. —

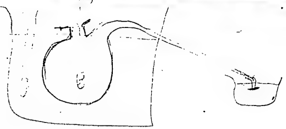
Bar 759.5 mm

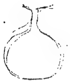
Boiling Pt CS_2 (Watts) 46.6°

Pure — a 47.9° = 1.8

(Barker) 46.0

Distill. of lot. gave from 45° 47.9° }





.38
8

99235
76
99159

99159) 287.693 (290.032
198318
892750
793272
984780
892431

892750
892431
319000
297477
215230

— NH_3 —

May 20. — Capacity & Coef of Expansion of Receiver. —

Temp 40.2

Wt Bulb = 380.742
93.051

Contents @ 40.2 = 287,693 gms

Density H_2O @ 41° = 0.99197
Density H_2O @ 40° = 0.99235

Diff. .00038
p.p @ .1° = .000038
2
.000076

Density @ 40°.2 = .992356
= 0.99228

x^{cc} @ .99228 = 287.693 gms

Contents @ 40°.2 = 289.933 cc

99228) 287.693 (289.933 cc
198456
892370
793804
985660
893052
926080
893052
330280
297684
32596

Temp 33.6°

Wt Full = 381.354
93.051
288.303 gms.

Density @ 33.° = 99485 40.2
" 34° = 99452 33.6
Diff .00033 6.6

p.p. = .000033
6
.000198 .00019
~~99485~~ 99452
Density @ 33.6° ~~99497~~ .99471

99471.)288.303(289.835 cc
198942
893610
795768
978420
895239
831810
795768
360420
298483
620070

Contents @ 33.6

289.835)289.933(1.00033
289.835
0000980000
869505
1105950
869505
2364450
2128845

6.6)000337(00005
33/0

Vols of NH_3 + Aq. —

−15	.996107
−10	997279
−5	998602
−0	1.
5	1.001472
10	1.003170
15	1.005059
20	1.007140
25	1.009373
30	1.011734
35	1.014247
40	1.016962
45	1.019531

Sp Gr = .9463 @ 12.5°C

Mnucke —
Ausdehnung
Tropfpunkt
Hunsfeiden

~~Mem~~

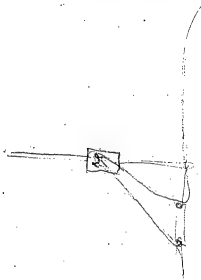
Acad. St Pet.
(Memoirs pres. par divers Savants)
(p. 352) 1831

Gave bubbles
@ 45°C

Menlo Park Notebook #108 [N-80-07-02]

This notebook covers the period July 1880. All of the entries are by Edison with the exception of one entry by Francis Upton. Included is a list of possible electrical inventions, two of which -- an electric balloon and an electric railroad to pull canal boats -- are also drawn by Edison in the book. There are also notes on vacuum experiments with lamps, notes on gold deposits in sand, drawings of an ore separator, and calculations by Upton of the amount of copper needed for a central station system. The label on the front cover is marked "T A Edison." The book contains 284 numbered pages.

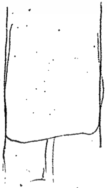
Blank pages not filmed: 12-25, 32-37, 40-53, 56-83, 86-101, 104-117, 126-127, 132-139, 148-187, 190-195, 198-243, 252-277.



allowing & to [illegible]

Canal System 1
RR Train System 2
Rockdrill, also Rock Tamper 3
Balloon — 4
Transfer power 5
High Speed Telgh RR — 6
System Signals for Electric RR 7
24 inch guage on canal with E Loco to draw 8
Canal boats,
Elevators 9 —
Submarine, Engine, 10
✓ System submarine, lighting 11
Submarine Electric Railway, 12
Steamship feeler for ship's Icebergs, 13
Lighting submarine buoys — 14
Emerywheel with 5000 Rev motor 15
Motor applied Lathes etc splice belts, 16

Over



Our system Lighting have Electric fire Engine to attach our mains 17, devise Electric fire Engine.

Ice sawing dynamo Engine. 18,

Portable Electric drill. 19

Electric Band & Circular Saw
can run armature with battery 20

Electric Well borers. 21

Torpedos.

Band saws

Circular saws

20000

10000

2500

3500

Qu. Whether

8 candle light

100 Ohms lamp

giving 1/4 per H. P.

10 lbs. of Cu

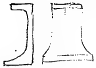
Or 8 of 16 candles

100 Ohms lamp

20 lbs. Cu. per lamp

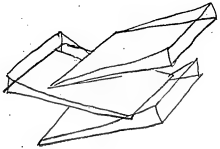
20 lbs. of Cu. per each lamp

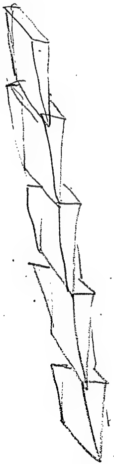
47 cts

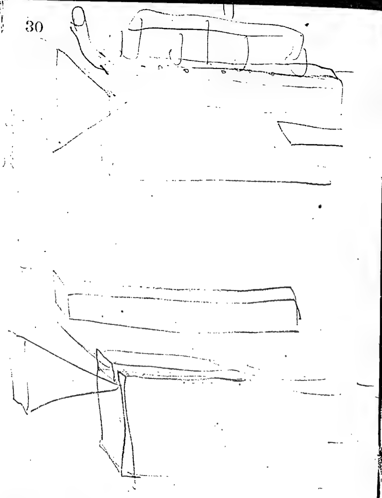


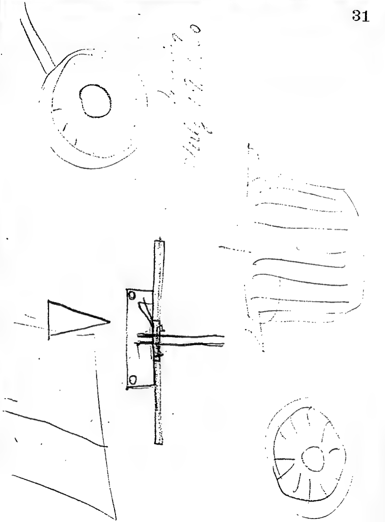
July 19. 1880

Mining.









5 000000

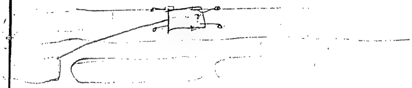
5°

5°°

$5°°

$5 00000

Jan. 6 [illegible]



150. 5 5°

150. 11.

1 75.

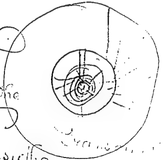
Fordwainer

To Fordwainer

Protochloride

Protochloride

Forsyth

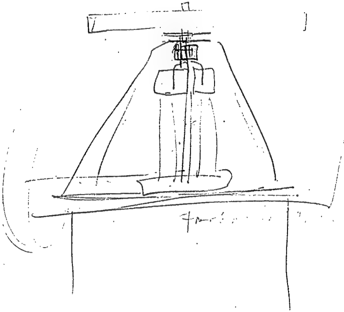


Forsythe

Forsythe

July 9 1880
TAE

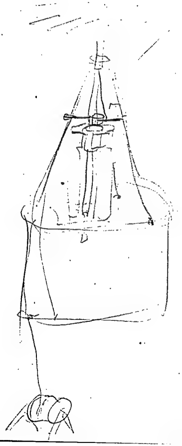
Electric Balloon Experiment



July 7 80

12

15



2

2,000.
1000
2,000,000

8400
42,000
12

29

42000
29
378000
84000
1,218,000

13
1300.

32
4
128
6
768

1300
16
7800
1300
20,800

2%

108,

36,) 1300

1300) 3600
2.7

1300
24
9100
2600
31,200

36,000
5
180,000

32
8
256
16
1536
256
4096

1300) 180,000 (138
1300
5000
3900
11000
10400

1300
138
10400
3900
1300
8,000.
179,400

138. C per lb Coal.

36, 3½ - lb Coal. 128. 36,

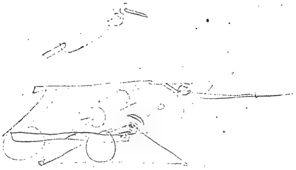
40
3
120

3½) 128 (

72

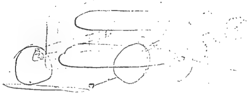
108,

July 8, 86



July 21 1880

[illegible]



Frenc

Fortune

60

60.000
60
3,600,000

Fortune

3

Fortune

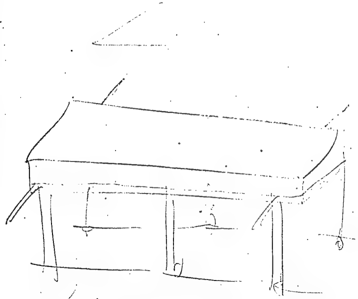
2

Fortune

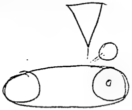
Fortune

Fortunate

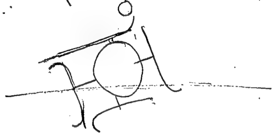
Fortune

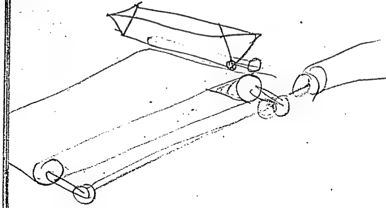


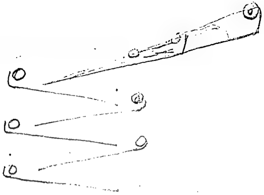
July 7. 80

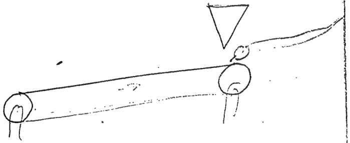


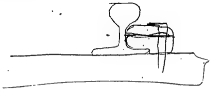
75.. 25

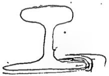


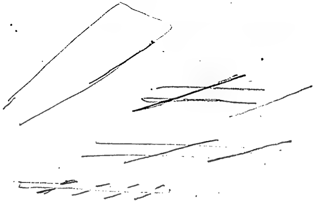


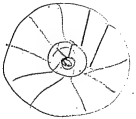




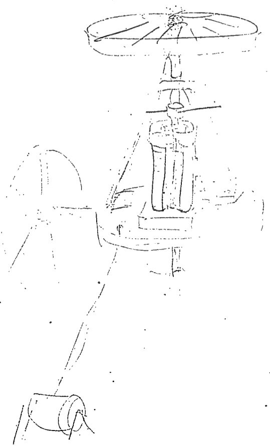








July 7. 80



July 7. 80

For 14-

July 7.80'

2200
3 60
22,000

15
120

594

.4

80.

15

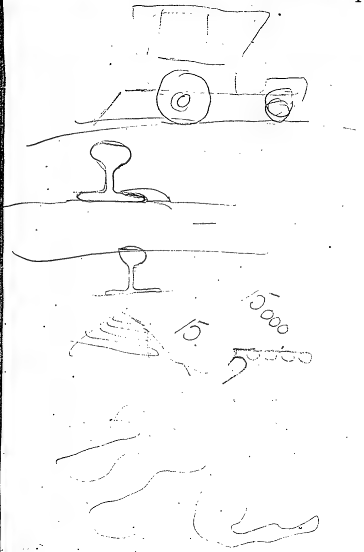
.4

250

125

15
20
300

80.

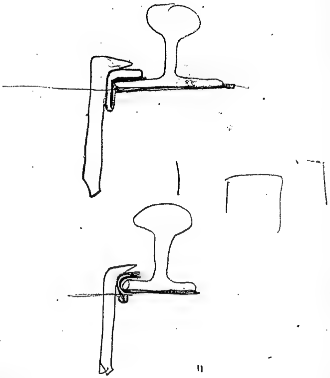


64
44
256
256
2816

14007

7

300) 3300 (
110
300
33.100



$\frac{3}{3}$

$\frac{1}{}$

$\frac{3}{30}$ $\frac{1}{10}$

$\frac{1}{10}$ $\frac{14}{1}$ $\frac{14}{10}$

$10\overline{)14}$

1.4

$\frac{1.4 \quad 60}{9.40}$ $\frac{1.8 \quad 60}{10.8.0}$

5 $\frac{1.8 \quad 60}{10.8.0}$

4

$\frac{6}{6}$ $\frac{3}{1}$ $\frac{13}{20}$

$\frac{1}{10}$ $\frac{5}{9+8}$ $\frac{12}{20}$ 10

$\frac{13}{20}$ 8 $\frac{8}{9+8}$ $\frac{2}{2}$

11

$\frac{\frac{13}{20}}{\frac{1}{10}+\frac{13}{20}}$ $\frac{13}{2+13}$

$\frac{13}{15}$ S $\frac{2}{15}$ Gal

$\frac{\frac{1}{10}}{\frac{1}{10}+\frac{13}{20}}$ $\frac{2}{2}$ 13 Lie Nuts

$\frac{13}{15}$ $\frac{3}{4}$ $\frac{39}{60}$ $\frac{6}{60}$

$\frac{45}{60}$ $\frac{2}{4}$ $\frac{13}{20}$ $\frac{2}{20}$

$\frac{6}{60} \times \frac{.329}{1000}$

329
1974
60000

$60000)\overline{19740}(.03$

$\frac{3}{4}$ $\frac{.329}{.1}$ 329 .987

$\frac{1}{4}$. $4.\overline{)19.7}$ 37 329

4.9

14.7 2

.329 $\frac{6}{60}$ $\frac{.14}{1}$

$\frac{6}{60}$ $\frac{1}{14}$

$60000)\overline{1974}$ .032 60

174000 $\frac{14}{60}$ 840

103

.18 60 .032 .18 60

10080 1920 10080 4

4

.180 60 .180 60

$\frac{18}{10.80}$ 1.0800 10.800

4

4

$\frac{3}{4}$ [illegible] $\frac{1}{20}$

$\frac{3}{80}$: $\frac{10}{10}$

$8\overline{)30}$ (.3 [illegible]

10 lights

$\frac{1}{10}$ of others $1\frac{3}{4}$

85

$\frac{50}{10}$ $\frac{3}{2}$ 5 $3\frac{3}{40}$

5 $\frac{51}{10}$

1.15 $\frac{50}{10}$ $\frac{51}{10}$ $\frac{3}{4}$ $40)\overline{153}$ 120 / 33

$\frac{30}{10}$ $40)\overline{150}$ 120 / 30 $3\frac{3}{4}$

$3\frac{3}{4}$

$\frac{5003}{5014}$

$\frac{1}{10}$ $\frac{3}{4}$ $\frac{3}{40}$ $40)\overline{300}$ 280 (.07

$3\frac{3}{4}$ $\frac{1500}{2004}$

$\frac{15}{4}$ 1.5 $\frac{1}{150}$

$\frac{3}{204}$ W $\frac{1500}{2004}$ W $\frac{1}{1504}$ 19

$\frac{3}{4}$ V

$\frac{1}{10}$ g @ $\frac{s}{g+s}$

$\frac{50}{10}$ $\frac{50}{10}$ .50

$\frac{50}{10}$ $\frac{10}{51}$ $51)\overline{500}$ s @ $\frac{g}{g+s}$

$\frac{5}{.51} \times \frac{3}{4}$ $\frac{15}{.204} =$ g

.73

$\frac{.1}{.51}$ $\frac{3}{4}$ $\frac{.3}{.204}$ $\frac{3}{204}$ V

$.204)\overline{15000}$ 1428 / 720 / 612 73

$\frac{1}{10} \div \frac{51}{10}$ $\frac{1}{51}$ .3 $\frac{3}{204}$

$\frac{1}{10} \div \frac{10}{51}$ $\frac{10}{510}$ $\frac{5}{1}$ $\frac{51}{10}$

$\frac{50}{10}$ $\frac{50}{10}$ $\frac{10}{51}$ 500

4

1

$\frac{2}{1} \div \frac{1001}{10000}$

$\frac{20000}{10000} \div \frac{1001}{10000}$ 20000

$\frac{200000}{10000} \div \frac{10000}{1001}$

$\frac{100000000}{10010000}$ 2000

1001) 20000

200 380 $\frac{19}{380}$

10000

$\frac{2}{10000} \div \frac{1001}{100000} \div$

$\frac{20000}{10010000}$

10000
1001

10000
10000
10010

$\frac{2}{1001}$

1001) .324

$\frac{2}{1} \div \frac{1}{10}$ $\frac{20}{10}$ $\frac{10}{1}$

$\frac{2}{5}$ 4 $\frac{2}{1}$

$C \frac{E}{R}$

ohm

1000 $\quad$ $1000^{v} = 4400$

$\frac{10}{0} = \infty$

2.v

$\frac{1}{1000000}$ 1 internal

$\frac{1}{10}$

2

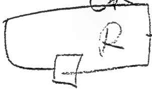
$\frac{1}{10000} + \frac{1000}{10000}$ $\quad$ $\frac{1}{1000000} + \frac{1}{10}$

$10 \overline{)1000000}$

100

$\frac{1001}{10000}$

$C \frac{E}{R}$



$CR = E$

$R = \frac{E}{C}$

$\frac{E}{R} \quad \frac{10}{2} = 20 \quad \frac{10}{1}$

100 $\quad$ $\frac{10}{0} = \infty$

330000

~~7460000000000~~

7460 3

60 2

46576 3

4

33000) 7460000000000 (244242

66

146

132

140

132

80

66

140

132

80

66

140

132

80

66

140

132

80

66

140

.414

33) 7460000 (226060

66

86

66

200

198

20

226060

443

678180

904240

9042400

1001000000

24424242424

443

7327272727272

9769696969696

9769696969696

10819939293812

1.3562325) 1000000000

.76

10|746

74.5

223.6

13.825

981

138225

110600

124425

1.3562325

443

60081099975

Menlo Park Notebook #110 [N-80-08-00]

This notebook has no dated entries but was probably used in 1880. All of the entries are by Francis Upton, with the exception of one entry by Edison, and relate to calculations for a central station system. Most of the entries are block-by-block calculations of the copper needed for the Pearl Street district. There are also a series of notes and calculations relating to the economy of the central distribution system and to the cost of a system of 10,000 lamps as compared to the cost of gas. The label on the front cover is marked "Hammer" and "N.Y. Cen. Station." The book contains 284 numbered pages.

Blank pages not filmed: 1, 138-284.

1013 [illegible]

127
27
887
4

of 1013 feet

$$\begin{array}{r} 127 \\ 33 \\ \hline 381 \\ 381 \\ \hline 4191 \end{array}$$

Block 2

1207 ... — Lamps 280

50

$$10 \overline{)330}$$
$$33$$

$$\begin{array}{r} 183 \\ 33 \\ \hline 549 \\ 549 \\ \hline 6039 \end{array}$$

Block 3

31
762

260
40
10 [illegible] [illegible]
30

36.1
30
[illegible] 3.0 fts

Block 4.

81 -
762 -

Lamps
10 | 340.
34

300
34.
1444
1083
1227.4 lbs

Birch 5

21-
462 -

140
25
10)165 Lamps
16.5

72.2
16.5
3610
4332
722
1191.30 lbs

21-
472 -

170
75
10 |245 lamps
24.5

27.6
24.5
1380
1104
552
676.20 lbs

Block 6

47

Lamps

120
50
170
17

27.6
17
193 2
27.6
469.2 lbs

831

10 | 8

Lamps

8

8

lbs.

Birch 7.

Ft. — Lamps

472 — 40
60

27.6
10
276.0 lbs

$10 \overline{)100}$ Lamps
10

Ft.

831 — Lamps
$10 \overline{)60}$
6

86.1
6
516.6 lbs

ft — Lamps

831 — 10)22.0 = 22

  86.1
    22
1.72 2
1.72 2
18 9 4.2 lbs

Block 9

Ft.	Lamps	
831	10/75. = 7.5	86.1 × 7.5 = 4305 + 6027 = 645.75 lbs
1065	10/310 = 31	

140.4 × 31 = 1404 + 4212 = 4352.4 lbs

186 × 31 = 186 + 558 = 5766

Bank 10.

71 Lamps

1065 — 10/230
23

140.4
23
4 2
2.8 5
3.2 2 9.2 Ans

186
23
558
372
4278

1013

127
125
635
254
127
15875

Birch 11

Ft — Lumps
120 — 11 | 125 / 12.5

Ft — Lumps
752 — 140
105
10 | 245
24.5

183
12.5
915
2196
2287.5 lbs

70.3
24.5
3515
2812
1406
1722.35 lbs

127
11
127
127
1397

Block 12

Jr: Lamps

1207 — 10 | 70 | 110 | 11

7522 —

40
70

10 | 110 | 11

183.0
11
2013.0 lbs

70.3
11
773.3 lbs

9r— Lamps

479 — 10 | 140 | 14

28.8
14
1152
288
403.2 lbs

Fr. Lamps

1207 — 10/20 2 183 2 366. lbs

762 — 10/20 2 72.2 2 144.4

479 — 10/280 28 28.8 28 2204 576 796.4

Block 14

Fr	Lamps	72.2
		1
762	— 13/10	72.2 lbs
	1	
396	— 14/40	20.0
	4	4
		80. lbs

71 Lamps
762 $10\overline{)40}$ 4 $72.2 \times 4 = 288.8$

396 100
40
$10\overline{)140}$ 14 $20.0 \times 14 = 280.0$ lbs

167 50
100
$10\overline{)150}$ 15

3.612
15
18060
3612
54180

Block 16.

71- Lamps

167- 40
10
30

15/80
80

3612
80
288.960 lbs

472- 10/30
3

27.6
3
82.8 lbs

Block 17.

31	Lamps	6.050
		9
220 —	10/90	54.450 lbs
	9	
472 —	10/80	27.6
	8	8
		220.8 lbs
831 —	10/110	86.1
	11	11
		946.1 lbs

Block 18

Ft	Lamps
831	10/80
	8

861
6
688.8

186
6.5
930
1116
1209.0

Blrah 19.

Ft. Lamps.

1065 — 10/65 6.5

140.4
6.5
7020
8424
912.60 lbs

1046 — 10/.75 7.5

137.8
7.5
6890
9646
1033.50 lbs

187
11
187
187
2057

Rivet Co.

Fl - Lamps.

1065 — 1/110.
11

~~14352~~
~~11~~
~~15752~~
~~lbs.~~

Fl -

1046 — 10/110
11

137.8
11
1378
1378
1515.8
lbs.

Block 21.

Ft	Lumps.	
396	10 / 55 — 5.5	20.0 × 5.5 = 110.00 lbs
479	10 / 50 — 5	28.8 × 5 = 144.0 lbs
167	10 / 65 — 6.5	3.612 × 6.5 = 18060, 21672, 23.4780 lbs
167	10 / 75 — 7.5	

3.612
7.5
18060
25284
27.0900 lbs

Block 22.

Lamps

167 ---- 10./130 / 15

3.612
15
18060
3612.
54.180 lbs

Block 23.

Ft		Lamps	
220	—	90	6.05
		60	15
		10 / 150	3025
		15	605
			90.75
364	—	10 / 70	
		7	

16.2
7
113.4 lbs

Block 24.

Ft.	Lamps	
1046 —	10/90, 9	137.8 ; 9 ; 1240.2 lbs
634 —	10/70 7	49.6 ; 7 ; 347.2 lbs
364 —	10/150 15	16.2 ; 15 ; 81.5 ; 162 ; 243.5 lbs

Block 25.

71-

1046 —

634 —

Lamps.

10/145

14.5

2.25

80

10/305

30.5

$$\begin{array}{r} 135.2 \\ 14.5 \\ \hline 6760 \\ 5408 \\ 1352 \\ \hline 1960.40 \text{ lbs} \end{array}$$

$$\begin{array}{r} 49.6 \\ 30.5 \\ \hline 2480 \\ 1488 \\ \hline 1512.80 \text{ lbs} \end{array}$$

Block 26

31 — Lumps 6.05
10.5
3025
605
63.525
lbs

220 — 10 | 185
10.5

537 — 10 | 110
11
18.25
11
1825
1825
200.75
lbs

364 — 45
20
10 | 65
6.5
16.2
6.5
810
972
105.30
lbs

Block 27.

71 — Lamps

$$\begin{array}{r} 16.2 \\ 8 \\ \hline 129.6 \end{array}$$ lbs

364. — 30. 30 60

634. — 10/80 8

$$\begin{array}{r} 49.6 \\ 8 \\ \hline 396.8 \end{array}$$ lbs

537. — 10/50 5

$$\begin{array}{r} 18.25 \\ 5 \\ \hline 91.25 \end{array}$$ lbs

Birch 28.

J1–	Lamps	49.6
		2.6
634–	10/260.	2976
	26	992
		128,96
		lbs

Block 99.

J1 — Lamps.

752 — 10/155.
15,5

70.3
15.5
35 1 5
35 1 5
703

10 89.65 lbs

Block 30.

ft.	Lamps.	70.3
		.8
752	10/60	56.24 lbs
	6	
1280	— 10/20	204.8
		2
	2	409.6
		lbs
479	— 10/210	28.8
		21
	21	288
		576
		604.8
		lbs

Dich 31.

Jr Lamps

479 — 10/200 = 20

28.8
× 20
576.0

Block 32

167 — Lamps
n/10$
16

1.806
.16
10836
1806
28896 lbs

Deck 33

Ft	Cases	6,050
		11
220	1.05	[illegible]
	5	[illegible]
	10/110	
	11	
637	4.5	
	25	
	10/70	
	7	

51.2
7
358.4 lbs

Block 34.

Ft —	Lamps	
537 —	10/90. 9	9.11 × 9 = 81.99 lbs
1057 —	10/50 5	137.8 × 5 = 689.0 lbs

Block 85

Fr — Lamps

1051 — 10 | 240.
24

137.8
24
5512
2756
3307.2 lbs

Block. 36

21 - [illegible]

1280. = 10|180
18

204.8
18
1638 4
2048
3686,4 lbs

Birch 37.

75.3	10|70	70.3
	2	2
		140.6 lbs

1280 10\|70

1

204.8
7
1433.6 lbs

Birch 38

753.

Lumber

704.8
12
8457.6

1250.

204.8
4
819.2 lbs.

Block 39

4 –	Lamps	70.3
		6
353 —	14/60	421.8
	6	lbs
1250	10/10	204.8
	1	1
		204.8 lbs

Block 46

Ft Francis

436 — 10/90
9

51,2
4
460,8 ft

Block 41

Ft — Pounds

636 — 10) 1.50
.15

51.2
15
256.0
512
768.0 lbs

Birch 42.

[illegible] — [illegible] 132

551 — 10.50 / 5 — 6.90 [illegible]

130 — 4.60 / 5

132

792 lbs

Block 43

71 · 127.8 / 9

1051 · 91 / 9 · 14.2

11.30 — 1/90 / 9 /

159.5 / 9

135.5 lbs

Block #4

80 ... 10.22

2

409

40.96

503.6

Block 45

Ft- Lamps

1280 — 10/70

7

204,8

7

1433,6.66

Block 46.

Ft — Leiques

1280 — 10/30 | 3

204.8 × 3 = 614.4

753 — 10/45 | 4.5

70.3 × 4.5 = 3375 / 2812 = 316.35

1280 — 10/45 | 4.5

204.8
× 4.5
1240
192
921.60

Block 47.

$$\begin{array}{r} 753 \end{array} - 10\overline{)110}\\ \quad 11$$

$$\begin{array}{r} 70.3 \\ 11 \\ \hline 773.3 \end{array}$$ lb.

Block 48.

Ft — Lengths

636 — 10 / 210

21

51.2
21
51.2
1024
1075.2 lbs

Block 49

"

Lampson

636

1/200

20

512

20

10240 lbs

Block. 50.

Ft Lamps.

1130 — 10/150
15

1597.5
15
7987.5
1597.5
23962.5 lbs

Block 51.

Lumps

71
1130

$$\frac{11|140}{14}$$

1595
14
6380
1595
2233.0 lbs.

4352
3229
912
1575
10.668

5766
4278
1209
2057
1331.0
10668
2642

Lbs
4941.
6039.
1083.
1227.4
1191.30
670.20
409.2
688.8
276.
516.6
1877.2
645.75
5766 ~~4092.11~~
4278 ~~2227.2~~
2287.5
1722.35
2013.
773.3
403.2
333.
114.4
400.4

35700

Lbs
Continuation
72.2
801.
288.8
248.
54.180
288.96
82.8
54.45
220.8
946.1
688.8
~~[illegible]~~ 1209.
1033.50
~~1575.2~~ 2057
1515.8
110.0
144.3
23.4780
27.09
54.180
20.75
113.7

8648.
35700
348

1240.2
347.2
243.5
1960.40
1512.80
63.525
200.75
105.30
129.6
396.8
91.25
128.96
1089.65
56.24
409.6
604.8
576.0
28.896
66.550
358.4
81.99
689.
3307.2
3686.4

17363.

OK

24630.
17363.
8648.
35700

86341, Total

lbs, corrected

86341.
2642.
88983

1103.

Weight - continued,

140.6
1433.6
843.6
819.2
721.8
204.8
460.8
768.
689.
792.
1240.2
1435.5
4505.6
1433.6
614.4
316.35
921.6
773.3
1075.2
1024.
2392.5
2233.

28.530
24630. corrected

144
84
60.

57.

84 -

16
9
144

50.

40
200
8000

3.

84

35.

84
15
420
84
1260

4.

12.

84
12
168
84
1008

50.

3200.

50c 9 per horsepower

9

16.

600 hours
7 per hp. 12 candles each.

Lamp 35c

300, 9 per hp 16 candles "

84
600
50,400
60

20 cents

14.45

Drexel Morgan

Morgan $30 24/100

16
8
128
600
76,800
60
4608000

1760.

Morgan

Morgan

30 24
14 45
$15.79

46.00
1760
28,40

16
7
112.
600
67.200 60.
403 2000

14 45.

14
35
70
42
490

1200
160
1040.

4000.

4000
1600
2310.

14.45

168.
16.
168.

At present lamps are
made which will give
16 candles for 1/8 of
a horse power of energy
in the shape of currents
of electricity.
That is 8 lamps may
be obtained ~~from~~ each
giving 16 candles for one
horse power or 33000
ft lbs. per minute of
available electrical current.

That is 8 lamps each
giving 16 candles if im-
mersed in a calorimeter
will show 33000

ft. lbs per minute given
to the water in heat.

The life of these lamps
will average 600 hours.
giving 16 candles, that is
if 10000 lamps are lighted
and a record kept of
the hours that they gave
light, the sum total of
the lighting time of all the lamps would
be 6000000 hours

At 8 per horse power of 16 candles the light is estimated as costing the company ¼ ct per hour that is for 600 hours $1.50

~~$1.50~~

Cost lamps .35

$1.85

For 10,000 lamps

For power	$15.000
for lamps	3.500
	18,500

Received from these at $1.50 per M

$45.000

18.500

Profit $26 500

8 | 124
16.
candles in eight places

for a H.P. of current.

12 | 128
10.7

~~10 per H.P. 12 candles each~~

10 per H.P 12 candles each

1/4 X 8 = 2 cts per hour

2 cts per hour
600 hours

$ 12.00 for 10 lamps horse power
3.50 for 10 lamps cost.
$ 15.50

$ 1.55 per lamp cost
to company

At 9 per horse power
there can be obtained
from the same plant
1/8 more lights

8 | 10000
1250
11,250 lights
.35 lamps
56250
33750
39375 0

15000
3937.50
$ 1893750

Receipts 45000
7575
52355

$ 52355
18937.5
$ 3[illegible]
26 500
6.917.5

Increase profits $

11 Lamps for 1 Horse power

11 Lamps for ~~H.P.~~ $.02 cts
600

$ 12.00
3.85

11) $ 15.85
$ 1.44

1.55
1.44

11 cts gain per Lamp

1/2 5.5 cts (to be added [illegible]

1/5 2.2 cts

Company sells 10 Lamps

Tests show that
10 lamps of 12 candles
each may be obtained
from each ~~horse~~ power
of electricity. That is
if such a lamp were,
when giving 12 candles,
immersed in a vessel
of water, the water would
rise in temperature at a
rate indicating that 3300
ft. lbs of energy were added
to it every minute in heat.
Such a lamp will last
on a average 600 hours

That is, if 10000 lamps were lighted at irregular or regular intervals and a careful record were kept of the time that each lamp was giving 12 candles of light, and after every lamp had ceased to give light these various burning times were summed up, it would be found that they had burned an aggregate

10000 X 600 = 6000000 hours

The lamps are considered as ~~burning~~ an equivalent to 12 candle gas; that is each one giving 12 candles may be thought as taking and equivalent of five cubic feet of gas for each hour ~~that~~ they are burned.

This unit is taken as it is found by experiment that the devices by which the light may be made so much more ~~effect~~ practically effectual add so much to the apparent light that

everybody is satisfied when told that it is giving a good gas jet.

Also that gas cannot be burnt in practice so as to give out the maximum of light,

shown by the photometer

while the electric light

~~must give the consumer~~

~~as much as twice the~~

~~tester at the laboratory~~

of 12 candles [illegible] will [illegible] 16 to 18 candles of effective light as compared [illegible]

5 2.560 000

365
25
1825
730
9125

365
20
7300
7.200
146 000
37.1
5 2 5 6 0 000

5 2 5 6 0
2.2 5
262800
105120
10512
118.260.00

15,750
37.725
30 000
6.700
46 900
3 000
75 000
5 000
$ 220.075
110
$ 230.075
36
20.5
1820
730
7482.5

76991) 220.075) 76991.0 (34.9

660225

1096950

~~1000375~~

880300

2166500

330.~~42~~) 76999.0 (233

660

1099

990

1.090

220) 3757 (170

220

1555

1540

1.50

330) 3757 (114

330

457

330

1270

Menlo Park Notebook #111 [N-80-08-18]

This notebook covers the period August-October 1880. Most of the entries are notes, calculations, and drawings relating to tests of carbon lamps, commencing about 8:00 p.m. on October 6, 1880 and continuing until about 4:00 a.m. The entries are by Edison, Francis Upton, Francis Jehl, and other laboratory staff members. The few earlier entries also relate to lamp experiments. The label on the front cover is marked "Upton," "Oct 1880," and "Lamps Lot 1." There is an index on the inside front cover. The book contains 282 numbered pages.

Blank pages not filmed: 36-37, 278-279.

Missing page numbers: 235-236, 241-242, 253-254, 263-266.

Index.

Average of Lamps tested, – 219, 258, 259, 261, 269, 271, 273, 275.

Analysis of Lamps tested, – 231[11], 233[21], 239[88], 245, 246, 267.

Carbons bursted and connected to Copper-Pole, – 187[11]

Carbons bursted and connected to Zinc-Pole, – 187[34]

Lamps – per hour – 211[12]

" – tested, – 1/14, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 31, 33, 39, 35, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 71,

" – 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 101, 103, 105, 107, 109, 111, 113, 115, 119, 120, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141, 143, 145, 147, 149, 151, 153, 155, 157, 159, 161, 163, 165, 169, 171, 173, 175, 177, 179, 181, 183, 185, 189, 191, 193, 195, 197, 199, 201, 203, 205, 207, 209, 240, 247,

" – Blue at Clamps, – 69[24], 117[27], 167[23], 240[43]

" – Not blue at " – 131[26]

" – Zero connected, (Aug. 15, 1880) – 32, (Upson)

" – Tables – 212, 213, 214, 215, 216, 221,

" – " – 223, 225, 227, 228, 229, 231, 237, 243, 249, 251, 255, 277.

TAE

~~20 Cells = L 64. R 64.~~

20 Cells = 32.

E. M. F. 223.

Candle	Lamp No.	
32	1388	This Lamp had at one of its clamps the carbon broken thus only a small portion was heated we did not put it up there to test its candle power
	1389	This Lamp when we had a small current on broke, it must have a very poor vacuum
	1431	

½

No 1406 TAE

32C This wanted

18 ft of German Silver
wire to make it
32C whe Dup 222

No 1427

This Lamp required 8 ft when def was 223°

Lamp No 1379

This Lamp broke when there was a very small current on. It broke at near the clamps it seemed as if it had a poor vacuum

TAE

No 1574

This lamp was
brought up to 32 C
when it bust.
The carbon was
curved over so that
the carbon nearly touch
the glass, Def 223

1396

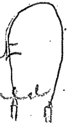
This Lamp was
without any Res
in the Circ 28.5 C
Def being 223

TAE

No 1360

This Lamp was at 32 C when adjusted so that it had 11 of the german Silver wire was put in, Def being 223. The carbon was curved.

No 1386

The carbon was split as shown and  when the current was put on it would arc.

Def 223

TAE

No 1435

This Lamp was at 32 C when Res adjusted so as to have 15 feet of German Silver ~~Sol~~. This Lamp was of German glass.

Def 223

No 1361

Carbon burnt.

This Lamp burst when only a small current was put on, Must have a poor vacuum.

Def 223

TAE

No 1398

Bad Carbon. Three bad spots in it Did not test it.

No 1391

Bent Carbon

Bad Spots, one at the top, and another at the side near the clamp. did not test its C power

TAE

1382

This Lamp was at 32 C when it had 10 feet of German Silver wire Def 223.

refer also to page 16.

1380

This Lamp with 10 feet of german silver wire was at 32 C when def was 223

TAE

~~1373~~ 1428

Lamp at 38 C when
E.M.F. 223. 20 cells =
32.

Ave Chem put This
Lamp a 32 C it required
8 feet of G.S. Wire.
Def 225L. R 228

No 1418

Lamp burst when
at about 48 C
Def. 225L. R 228

TAE

No 1382

Lamp at 48 C required 5 feet of German Silver wire. Def 225 L. 228 R

refer also to page 12.

No 1424

Lamp at 48 C required 10 ft of G.S. Wire Def L 225 R 228

TAE

No 1395

Carbon Little Beauty
7 feet required to make
it 48 C when def was
225 L. R228

No 1421

This to make it
48 C it wanted 11
feet of G. S. Wire
Def 226 L. R 228.5

TAE

No 1423

Low Vacuum
Carbon oxized when
small currents

No 1410

without Res 32 C
E Ue 7. R 228 L 225

TAE

1420

feet to make it 32 C. a spot on one of sides. Def 225 L 228. R.

no 1384

Carbon bent
at 48 C when it required
3 feet of G. S. Wire
Def R 230 L. 228

JRL

1433

Ab 48 C when it
had 3 feet of G. S. Wire
Def 225 L. 228 R.

To ~~1386~~ 1391

Little bent
This has two bright
spots, one on the side
and the other near
the clamp.
Buckled on the bright
spot on the side.

~~1386~~

Bad Carbon
burstes at a low
current.

1422

E M 7 223

put on at 9 15

one side seemed to be
a great deal brighter
than the other.
at 17 C 15 C

TAE

No 1440

5 mins Bass fiber was put in a nical mould and while white hot gasoline gas was blown against it. I put it up at 48 C. was out at five minutes then the engine stop.

TPK

In the morning put on at 48 C at 8.33

In the morning was put on again at 8.33 at 48 C

E M F = R 234. L 2.32

This Lamp bursted at 8.57

Making it 23 minutes that it lasted.

8.33
[illegible]

11-30 Blue running back one wire

11-36 reached the end of wire

11-38 commenced on other

In gauge

11-40 Blue filling one side of globe

11-46 Reddish tinge. Just in tube, rapping in fall tube.

Aug 18.

His experiment with the four glasses (those which support the carbons). The one which had the

White ends had a slight red phosphorescence and green ~~[illegible]~~ at the glass. poor vacuum.

The one with plain glass had a slight red phosphorescence but poor vacuum.

After dark

Spark tube alone

7.26 | Blue on one wire

7.23 | Glass green
Blue [illegible]

TAE

34 | Conduction [illegible] one
end red on other
[illegible]

Just before tube

35 | dark [illegible]
1.36 | Commencing to spread [illegible]
other side light [illegible]

7.37 | reddish pink [illegible]
side light on the other

bands of pink glass
bluish fluorescence,

Bands fading in [illegible]

7.39 | One wire light pink the other
greenish. vac at 75

7.40 | vacuum 78.

7-42 | Vacu 88.
two bands very light
....

7-45 | Light blue [illegible]
V- 90
Vacuum [illegible] went down to
78

Test on 100 lamps on table. Oct. 6, 1880

Lamps brought up to dull red and bad lamps picked out as followed

\# 26. Spotted.

\# 69 "

\# 81 "

\# 54 Bright at top.

\# 100. " " "

\# 44. arc. between clamps,

\# 54 vac. gone, oxidysed at top

\# 99 # 28. # 66. carbon broken gone no light. never lighted in test - was busted in Jahls ~~tests~~

73 - went in the clamp -
J W

~~44 went finally put it~~

Reo on 44 · burned out

44 had a bad contact
in clamp sometimes it
would make good contact
& loop burn OK then you
would see sparks between
the carbon & clamp &
an arc light blue 1/4
inch dia jump across
then it would weake

13/21.

3:04

36.

Geo K Crutard again
Iso ai a

One lamp brought
was just at red
while its neighbor
was giving about
8 candles; the one
that was red had
bad vacuum on feeling
the globe the 8 candle
was the coolest
Shewing Enormous loss
Energy by air Conducting

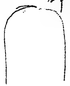
in a low vacuum

time 8 oclock 5 min
~~Res~~ 53 - abnormally high ~~blue~~
95 Little higher that
ought to be -

~~Started~~ 8,05 PM
EHgs watch
8.12 by clock —

✓54- went at top

Split



one mins =

0.1 degree)-

✓58. went at top 10 min

at 8.27 we found EMF Not quite right. took EMF from [illegible] on table & brought it up 2 Volts more than the right amount to allow for heating of Res Coils

Rate See p 53

52 low.
53 abnormally high

51 fair.	68 fair
55 "	69 fair
56 "	70 fair
59 fair	72
60 fair	74 fair
62 } fair	76 fair
61 }	77 - fair
63 High	78 "
64 fair	79 80 81 - fair
65 Extra fair	
67 fair	83 - very poor n.g. blustery day

49. went in Carbon -

26 minuts to 9.

8.34 PM

53- went in glass

8.34 ½

22 ½ min Total Time

84 - good
85
86 fair
87
89 - little low
90 "
91 fair
92 little low
93 low
95 very bright
96 - fair
97 - fair
98 "
100 - low

See p 61

1 fair
2
3 high
4 high
5 fair
6 High
7 high
8 High
10 fair
11 good
12 good
13 fair
14 high
15 fair
16 fair
17 low
18 fair
19 fair

20 low
21 very poor
22 fair
23 fair
24 little high
25 fair
26 bent Bad Spot [illegible]
29 pretty high
30 low
31 low
32 fair
33 fair
34 fair
35 fair
36-7-8 fair
39 high

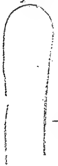
No. 95 – ~~8~~ top

8.39 pm

total 27 m.

9 K 2

68 – went



8.41 pm

total 29 m.

Nov 26. - went 841 - it had bad spot - when it went it gave an arc as it burned its record

Coil -

TW?

total time 29 m

40 fair

41 fair

42

43 pretty fair

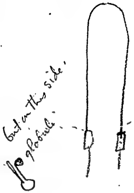
45 fair

46 fair

47 little high TAP

48) fair
50)

/ Busted in Carbon
32 - time - 8.52 pm.



plat clamp it
was flue on
The clamp -
investigate see if it actually
a plat clamp -

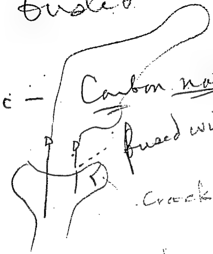
(Sic. Carbon vapor oriented by polarity gives the arc)

~~total~~ Time 40 m.

This shews that an arc passed as the globule was on the clamp where Carbon melted + the Real Coil burned out at moment of busting carbon

24 - time 8.56 pm

busted TAE



Arc - Carbon not busted

fused wire at glass

crack in glass

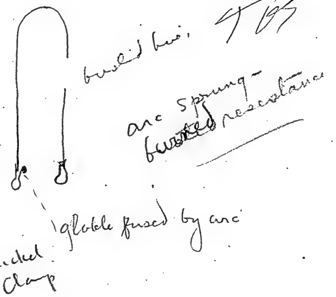
Risio burned
luna

plat clamps

~~???~~ no black on clamps
dont think there was blue, Evidently
the glass cracked let in air & an arc
sprung & burned the wires ~~the~~ over

The arc being below the carbon saved it + the platina being in partial vacuo of course got to melting point before pt outside in air

√ 69 - went at 9 oclock



List of those blue at
Clamps at 903 –

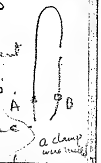
97 –	80	50	
18	34	64	
20	79	62	very little
23	35	60	
25	76	57	good deal.
83	37	52	
29	39	51	
31	71		
33			

TPR

No. 4 busted 9.08

The Carbon is broken dropped down but cant say if it was by Current

wire melted at glass. Res. burned out shewing arc



~~but don't see how arc was [illegible]~~

~~the Carbon [illegible]~~ Think whether this arc was from doubtful?

37 - busted 909 -

THE

No 3 busted 9.21 - PM

busted in glass - arc

Resistance burned

plat clamps - no

black on them.

plat was not burned at

glass still standing

TAE

No 14 Busted 922

arc-Res burned.

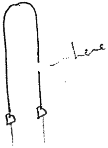
block on one clamp i-

platinum burned at

glass

TAE

✓ 39 - busted at 926



THE

✓ 6 busted at 9-34

The resistance burnt first
then the carbon oxydized
all over gradually 5 sec.

No 10 - at 939 pm

Busted in glass

Resistance burned

Carbon glass etc all

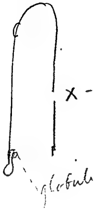
warped -

plat clamps [illegible] The

After test one of clamps

black at all

No 12 - at 9.46 pm -



TAE

arc across + busted Carbon at x

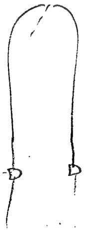
Resistance Burned

no black on clamps which are of platina.

No 35 9.47. pm busted

had bad spots uncovering all the time

busted here TAE



Shows shining Carbon on parts of loop by Carrying

No 9 at 9.54

~~Coarse~~ Large bamboo

platina clamps
no black on them TAE

arc sprung Res
burned

platwire burned at
glass — Crack across
also

Think carbon was broken
mechanically

I notice in looking through blue specs that quite a number are brighter around the loop

these

TAE

also some few are bright near clamps

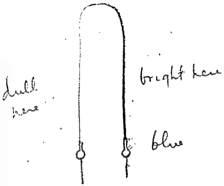
72 busted at 10,03 pm

platina clamp

had bad spot near clamp was rather high. arc sprung & melted plat $\frac{1}{4}$ below clamp

No 7

I notice No 62



TAE

I notice No 33 · is lk

✓ No 7 - 10.09 pm

Went.

TA9

No 33 - Went at 10 15 PM

Split on Carbon but not busted

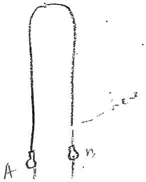
Lampblack on spring

TAE

Arc sprung Resistance burned -

But put other Res in wall
Cap wire when it
became incandescent & arc
sprung glass busted

No 13 at 1016 -



TAE

pl Cat clamps
Just slightly [illegible]
in A side.

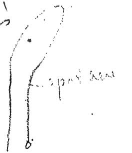
Res [illegible]

82 — 1019 pm —

Busted in glass all went to pieces.

TAE

2 make this



No 2. 1020-pm

— here little smoked in glass

~~4~~08

plat-clamp with black

Resistance did not burn

No 8. 1022 pm

A

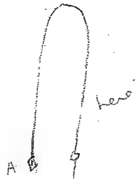
— here little blackened in glass

plat clamp TOE?

Exceedingly slight tinge

blacke on A.

No 63 - at 1025

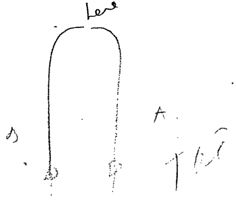


1 Mil

plat clamp here ok

plat clamp at A very black

62 bursted at 1031



Nickel clamps Res OK.

Did not appear to be any black

on clamps but notice black on thick

part of carbon & a polished carbon carrying

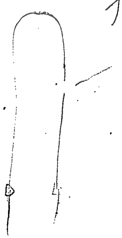
This was the lamp that

was bright on A side & Dull on B

76 - at 1033,

had a spot. this spot kept on for about hour suddenly grew big in 5 sec, Vapor of Carbon shot out arc sprung Rec Burned

TAE



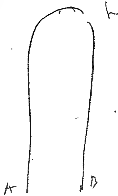
1041 we stopped to fix
brushes started again
at 1050 -
9 - minutes to
be subtracted -

---

56 finished at 1054 GAE

Hanger end was split in clamp
probably made bad connection
as arc sprung & burned
Resistance, but carbon
intact

No 67 – busted at. 1056.



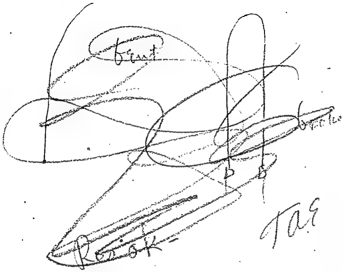
TAE

Nickel clamps – A very
very black B somewhat black.
Arc sprung Res burned

I notice that the extra bad Vacuum Lamps have their Carbons very much bent over these dont give more than 4 or 5 — Candles. (theres only two -
There is not one Carbon in the whole except the above two that is not straight Enough & the great majority are quite straight =

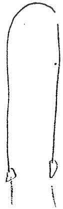
TAE

No 6~~4~~= at 11 13 pm



TAE

broke there



Nickel clamps check
No Res in this one

11 25 pm

Blue at clamps

50	81
48	80
45	71
34	61
31	60
30	59
29	57
25	55
23	52
22	51.
20	
19	
18	
100	
98	
97	
83	

TNE.

19 & 22 doubtful as [illegible] didn't take water around blue first 20 or 30 clamps

~~19 + 46~~

~~get~~

10 19 22 45

48 81 55 have

got blue since last taking blue on page 69 –

79 - at 1128.

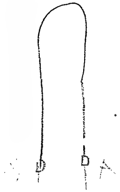
TAE

Carbon was intact.
but could see that it was
badly split at clamp
& clamps were both
~~[illegible]~~ blackish slightly
kind of || bluish oxide —
are Sprung - Resistance
turned out.

Quantity
200 -
dif EMF between 1 ohm lamp & 200 ohm lamp
16 candles or greater 48,

vac
82/100 at 48
67/100 at 16 -
Therefore dif
increases,

61 Busted at 1150



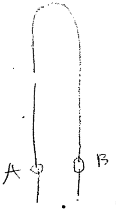
TAE

Nickel - deposit Spiral of lamp
blackening ... on bulb
most in A.
Resistance

Some doubt being Expressed
that the lamps (1e) majority
were at 48 candles & took
out a lamp in Res. that
looked like 30 to 35 of the
majority were 48 & measured
Candle power down stairs.
No was. 80. took off at 1155 put back
at 1205 am - measured 35 candles

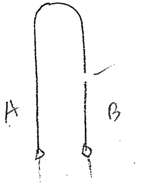
No 20 1155 TRE

Res OK



Nicked clamps
block at A.
being carrying
Shunning Carbon
one side (1e) A. Carbon
on B side Block -

No 30. at 1150.



TAE

Showing Carbon
on A side black
on B side.

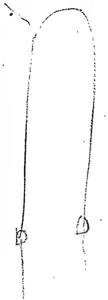
A clamp full Lampblack

Some on B . . .

arc (slight)
must have
spring

Resistance Gained
little

No 70 at 1158

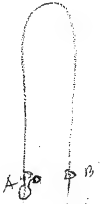


TAE

plat clamps
dont appear to be
block at all
Resistance Not burned

52 busted 1201 AM-

Arc spring



TAE

pivot

Nickel clamp blade
on both.

Resistance burned.

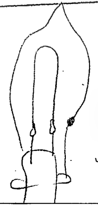
The ones that have no blue are at 1210

96	78	17
93	77	16
92	75	15
91	74	5
90	65	1
89	47	
88	43	
87	42	
86	40	
84	36	
	21	

TAE

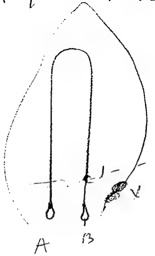
Phenomenon.

See 132 Page



spot lamp 96 as nickel clamp is very close to the glass perhaps oxide from clamp

No 78 1216 AM.



TAE

saw while incandescent a spot here growing off vapor Carbon in straight line. this vapor impinging on glass gave this spot X which I suppose was due to nickel as set forth on page 132 - The arc suddenly grew large & then abnormally increased burned Resistance the side A on clamp when Carbon broke was white heat ?
Carbon [illegible]
saw [illegible]

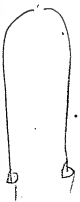
57-' at 1220 -

Exploded like a
pistol - TAE

No 100. 1235 am

Burned splendid & high
all Evening got spotty
last hour weak at top

TAE

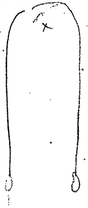


Carbon ~~putty~~
shiny showing
Carrying pbly
due to these spots

Nickel Clamps
has black specs
Lamp Hoof

Res OK

25 " 1247 - AM



TAE

block on back of lamp

x is a splint covered with Lampblack = rather scattered on glass - resistance ok.

74 — at 1250

TAE

nickel black on clamp A

glass cracked

Rucostam burned

-trunk split in clamp

plat wire burned off on B side

83 at 1252 =

Bad one Cut touched
glass then burned
hole + oxidized all
up – no R in

TAE

47. 1.02 am –

~~plat clamps~~

Res burned

burned off plat.

wire 1/4 inch from

Clamp on B side

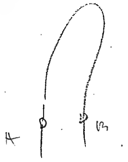
FAG

B A

dont know if was broken by current or mechanically

one clamp slightly black very slightly

31 ✓at 103 am



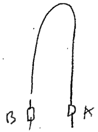
Showing carbon on a side also on B but there some black spots

Res OK 151 mm

TAE

Lampblack on B Clamp

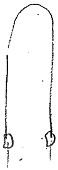
42 at 105.



Res burned arc
~~plat clamp~~
both bright
~~burned platin~~
at glass, on A side

TAE

59 — at 116 —



Res burned arc spring

B D. DA Lamp black all over glass in specs

A clamp very black

Has Mercury in globe

TAE

39
60
60
60
40
60) 9.1

8.21

at 1.20 AM –

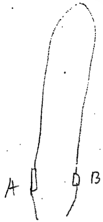
as a 48 candle lamp

I pick out No 65 & Francis
take it with its rheostat
down stairs to see if it is
really 48 Candles =
after taking it off I noticed
globe somewhat blackened
but then there had been
blue all over globe for
some time = measured
30 Candles but think
that the blacking of the
glass made big difference
We take at 1.39 am No 91 which
appears very bright & found it to
be 31 @ 2

Put 65 back at 1.40 am

46 at 130

Co.



Res burned
arc sprung

A clamp
very black.

Small end of screw on A
clamp fused

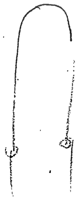
TAE

Apparently these lamps are about 30 candles instead of 48 = I dont believe that they have been any brighter than they are now & from these test ~~& judgment~~ its apparently [illegible] 30 candles for the brightest =

TAE

19 — 155

Lamp black spec
allow glass Res
burned arc
both clamp-nickel
blued-



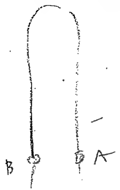
TAE

at- ~~135~~ 1-35 probably am we

put no 91 which was
31 @ 32 Candles to 48
candles + brought all
the remaining lamps
to that EMF which
was 178 Volts.

TAE

No 55 145 am

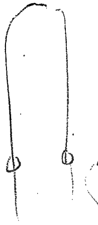


A very black

Res ok B. slightly

TAE

96 ✓ 1 50 AM



Rgo ok

R1

TAE

plat clamps
both bright.

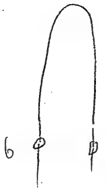
at 2:04 am

we Read blues at clamps with 178 EMF or Volts

17	51	89
18	60	93
22	71	97
23	75	98
29	80	
34	81	
41	85	
45	86	
48	88	
50		

TAE

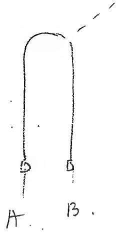
No 60 at 212 am



nickel clamps
Specs Lampblack on
a no Res in
ckt

TAE

No 41 - at 213 am



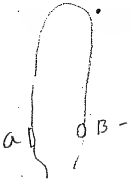
Nickel clamp

B, block

Res OK

TAE

84 at 215

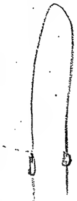


Res ok

arc, - Wire (platina)
of .B. melted at
glass

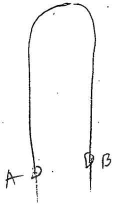
TAE

65 = at 216 am



plat clamps
bright. The
Res burned
by arc. Glow
nearly brown

71 $216\frac{1}{2}$ am.

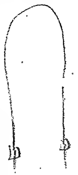


Restarted arc

TAE

A very black large feathers of lampblack thrown over on glass

Nov 15 at 230 am



plat clamps

Res OK

TAE

This is a clean straight

& to be expected but

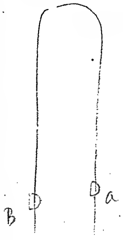
of the carbon

No black on clamps

at 2 30 am . 6 hours & 20 minuts
from start 33 lamps still
going out of 97 that started

TAE

51 at 235



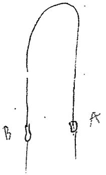
specs Lampblack made
thrown on glass

Res Grounded

Specs Lampblack
on a & B Grounded
[illegible] Lampblack

TAE

No 22 237 am



Res burned

A clamp nickel
Very black

Mercury in globe

B clamp browned

TAE

Carbons busted Lowards + Connected to Zinc pole

15
19

34

Lowards + connected to Copper pole

N

11

TAE

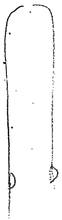
No 16. 243 am

Res OK

flat clamps no black

broke as it showed in Carbon TAE

21 247 am -



no Res
Low Xg
[illegible]
[illegible]

[illegible]

29 Clamps alive at 3 oclock.
178 Volts left

38 at 310.

Split in Clamp

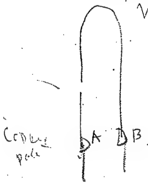
arc went but didnt
Dinge Res - one clamps
got white hot & in
3 seconds glass broke
& busted Carbon
all pieces mechanically

TAE

No 18 322

Shiny Carrying
Specs lamp black on
nickel clamps

Res O.K

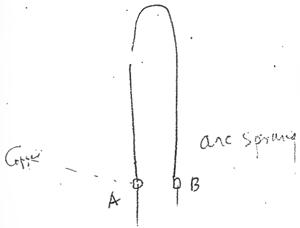


Carbon block
B side -
Shiny Carbon A side

TAE

81 - 3 31 am

Reo turned



A very black in nickel
Clamp -

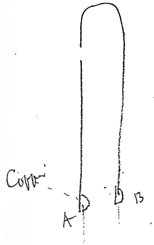
Carbon at a apparently
a little loose in
clamp.

50 - 334 am

arc - Resburned
platinum melted
at glass
Carbons broken
Cant tell

TAE

97 — 334½ am



Res not burned

Little black on
nickel clamps
spots Lampblack
thrown on glass
near break of filament
of it hanging to
Carbon near break

TAE

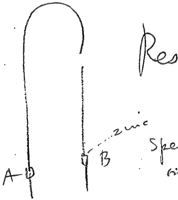
with the 178 valts
No 91 has fallen
from 48 candles at 2 oclock
to - 39 candles at 356 am shewing
~~that~~ air comes out &
reduces economy even
~~after it has been at 48~~ -

They now use 91. &
~~increase the valts~~ to
~~___~~ & bring 91 to 48
candles again - and all
the other lamps come
up with it -

TAE

23 lamps burning at 4 am

85 at 404 am



Res ok

Specs Lampblack or fing on glass

near break

A block in clamp

TAE

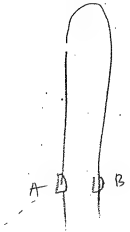
91 = fuses changed on poles

Busted 8.10. am

Res OK – no arc

glass clear

34 = at 350 am



A zinc
block

Carrying
Shunny Carton
on B Side

Res OK

TAE

80 ✓ at 406

Res OK.

Carrying + Shining Carbon on A Side.

A-block
nickel clamps -

TAE

Put on

No 1
Busted
7.35 am
negative

glass clean
Res OK -

~~47 Cot-1~~

~~1.30 P.M.~~

~~Res burnt.~~

positive

Stopped at

Nos These Lamps

are to be taken off & tested for Economy

47 ✓ 17 ✓

45 ✓ 86 ✓ 98 ✓

43 ✓ 87 ✓ 1 ✓

40 ✓ 88 ✓ 5 ✓

36 ✓ 89 ✓

75 ✓ 90 ✓ 91 ✓

~~33~~ 92 ✓

93 ✓

TAKE

put these lamps down to yellow & found 12 perfect No Spots

Platina	Nickel	Res Burnt	Bad	
24		/	/	[illegible] but wire burnt [illegible]
	25		/	
	26	/	~~/~~	
~~29~~			~~/~~	Whole white dep. on carbons
	30	/	/	White deposit on carbon
	31		/	
32		/	/	
	34		/	
	35		/	
37			/	
38			/	
	39		/	
	41		/	
42		/	/	
	44	/	/	

Platina	Nickel	Res. Burnt	Bad	
No 2			/	
No 3			/	
No 4		/	/	
No 6		/	/	
No 7			/	
No 8			/	
No 10		/	/	
No 9		/	/	
No 12		/	/	
No 13			/	
No 14		/	/	
No 15			/	
No 16			/	
~~No 18~~	No 18		/	
	No 19	/	/	
	No 20		/	
	No 21		/	
	No 22	/	/	
	~~No 23~~		/	Marked not in the book white deposit on carbon

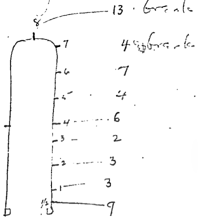
TAE

Platina	Nickel	Res Burnt?	Bad
	46	/	/
	48 (?)		/
	49		/
	50	/	/
	51	/	/
	52	/	/
	53		/
54			/
	55		/
	56	/	/
	57		/
	58		/
	59	/	/
	60		/
	61		/
	62		/
63			/
65	64		/
		/	/

Platina	Nickel	Burnt Res	Bad
	67	/	/
68			/
	69	/	/
70			/
	71	/	/
72		/	/
	73		/
	74	/	/
	76	/	/
77		/	/
	78	/	/
	79	/	/
	80		/
	81	/	/
	82		/
	83		/
84			/
	85		/

Platina	Nickel	Res Kunst	Bal
	95		1
96			1
	97		1
100			1

Analysis



The breaks occur on both sides but I have marked them all on one side.

[illegible]

	Volts	Ohms	Lt. Cds, min	
1	147	188	5090	
2	143	172	5260	
3	152	188	5440	
4	137	154	5400	
5	140	167	5200	
6	154	195	5380	
7	158	188	5880	
8	156	180	5990	
9	156	182	5910	Carbon broke
10	143	178	5090	
1	143	177	5120	
2	156	209	4920	
3	141	183	4810	
4	148	195	5040	
5	146	177	5340	
6	137	169	4920	
7	142	179	4990	TAE
8	143	204	4440	
9	146	~~[illegible]~~ 179	5480	
19	27.68	3464	99700	

	Volts	Ohms	M-Vs
20	154	201	5230
1	~~too~~	high	—
2	140	168	5170
3	140	172	5050
4	160	239	4750
5	142	158	5656
6	154	191	5500
7	~~Broke~~	~~in testing~~	
8	Broke	in	testing
9	142	168	5320
30	142	158	5656
1	154	211	4980
2	160	196	5780
3	162	233	4.996
4	148	189	5130
5	164	223	5.240
6	144	183	5.020
7	148	185	5.250
8	128	177	4230
9	152	172	5950
20	2334	3224	499018

TW

	Volts	Ohms	Hrs.	
40	134	163	4888	
1	148	208	4660	
2	148	192	4850	
3	138	171	4930	
4	156	202	5340	0
5	144	212	4320	
6	142	177	5046	
7	140	171	5677	
8	142	163	5480	
9	174	213	6296	26
50	158	206	5437	
1	146	180	5246	
2	168	192	6516	
3	132	182	5623	oxydized
4	too high			10
5	164	198	6017	
6	160	201	3642	
7	164	188	6348	
8	Broke in testing			
9	148	194	5001	
	2706	3413	76537	

0

100

110315.1
5157.

	Volts	Amps	Ft lbs	
60	146	214	5706	
1	156	179	6022	
2	158	212	5216	
3	152	191	4918	
4	160	233	4867	
5	142	168	5317	
6	156	198	5448	carbon broke
7	152	207	4942	out
8	162	217	5357	
9	144	194	4735	
70	150	201	4959	
1	144	169	5435	
2	150	200	4983	
0 3	162	231	5033	
4	154	200	5253	
5	134	162 THE	4910	
6	150	199	5008	
7	146	197	4803	
8	144	191	4610	
9	156	210	5130	
20	3038	3973	113151	

Lamps	Volts	Ohms	Ft-lbs
21	2490	3052	82255
20	3038	3973	103181
20	2706	3413	[illegible]
20	2534	3224	99008
19	2708	3464	99710
[illegible]	3476	17136	480651

9 Bad

92

Volts

13476 / 146

92 / 480651 / 5224

92 / 17136 / 186

146 average in Volts.
186 " Ohms.
5224 " Ft-lbs.
No of Lamps 92 [illegible]

	Volts	Ohms	Ft-lbs
80	144	182	4840
1	146	198	4778
2	too high		
3	too high		
4	136	167	[illegible]
5	138	168	5030
6	138	179	4720
7	130	171	4960
8	136	175	4432
9	142	203	4352
90	124	164	4053
1	132	160	4825
2	146	183	[illegible]
3	152	200	5117
4	Broken testing		
5	140	178	4877
6	142	185	4828
7	148	167	5199
8	144	171	537[illegible]
9	Broken		
100	152	204	5017
21	2400	3062	82255

TAE

Average of the 91 lamps tested

13476 4.1294

91 lamps 1.9590

2.1704

148.1 Volts

17136 4.2338

1.9590

2.2748

188.2

480641 5.6818

1.9590

3.7228

5282 4.5185

.7957

6.2 per H.P 1.6812

46 2.4769

300 candles per H.P.

TAE

 Total Ohms

24 | 3968 | 165
24
156
144
128
120

24 | 116003 | 4833
96
200
192
80
72
83
72
11.

24 | 3174 | 132
24
77
72
54
48
6

average 165 · average in Foot Pounds 4833 · average Volts 132

with 24 lamps
Polished at the clamps.

Averages of 21 Lamps with blue on the clamps.

Total Volts.

21 | 3174
151 Average.

Total ft lbs.

21 | 116003
5523 Average.

Total Ohms.

21 | 3968
188 Average

~~Blew at~~

Lamps	Minutes
58	10
49	22
68	28
82	40
37	57
39	74
76	142
61	209
20	214
30	215
52	220
51	239
10	254
25	266
83	271
31	282
59	295
19	314
55	324
60	351
71	356
51	374
22	376
21	385
18	421
81	440
50	443
97	444
34	459
80	475
30	

Ruled by TRW

	Total Lamps	Total Time	Ft. Cds
0-100 minutes	15	163 208	5725
100-200 minutes	12		
200-300 minutes			

TRE

22159

Average burning time of 82 lamps which did not last of first lot from the factory.

Total no of min 22159.
" " " Lamps 82
Average ——— 270 min

~~Three~~ Six lamps lasting at about 700 min = ~~21~~ 4200 ~~Horses~~ which added to the total makes the Grand Total, ~~21259~~
Total No of lamps. ~~51~~ 88 lamps
Average ——— ~~[illegible]~~ min,
22159.
299

Refer to. Page 247

T.A.E.

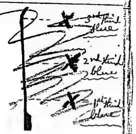
43 lamps that were blue at the clamps out of
38

Unaccounted for

~~9~~, 11, 27, ~~23~~, 29, 44, 48
~~66~~, 73, 94, ~~99~~

8 lamps
3 lamps broken at first
11 lamps
89 lamps to be accounted for
On table 89

No of Lamp	not Blue	1/3 up	2nd third	3rd "	No of Lamp	Not Blue	1st third blue	2nd "	3rd "	No of Lamp	no Blue	1st third blue	2nd " blue	3rd " blue
□ 1	0	0	0		□ 40	0				✓ 80		0	x	x
✓ 2	0				✓ 41	0				✓ 81		0	0	x
✓ 3	0				+ 43	0				✓ 82	0			
✓ 4	0				~~44~~		x	0	0	✓ 83		0	x	x
+ 5		0	0	0	+ 45		0	0	x	✓ 84	0			
✓ 6	0				✓ 46	0				✓ 85	0			
✓ 7	0				□ 47	0				+ 86	0			
✓ 8	0				~~48~~		0	0	x	+ 87	0			
~~9~~	0				✓ 49		x	0	0	□ 88	0			
✓ 10	0				✓ 50		x	x	x	+ 89	0			
~~11~~	0				✓ 51		0	x	x	+ 90	0			
✓ 12	0				✓ 52		x	x	x	□ 91	0			
✓ 13	0				✓ 53	0				+ 92	0			
✓ 14	0				✓ 54	0				+ 93	0			
✓ 15	0				✓ 55		0	0	x	my side ~~94~~	0			
✓ 16	0				✓ 56	0				✓ 95	0			
□ 17	0				✓ 57		x	x	x	✓ 96	0			
✓ 18		0	x	x	✓ 58	0				✓ 97		0	x	x
✓ 19		0	0	x	✓ 59		x	0	x	+ 98		0	0	x
✓ 20		0	x	x	✓ 60		x	x	x	~~✓~~ 99	0			
✓ 21		0	x	x	✓ 61		x	0	x	✓ 100		x	0	x
✓ 22		0	0	x	✓ 62		x	x	0					
~~23~~		0	x	x	✓ 63	0								
✓ 24		0	x	0	✓ 64		x	x	0					
✓ 25		0	x	x	✓ 65	0								
✓ 26	0				~~66~~		x	0	0					
~~27~~	0				✓ 67	0								
~~28~~	0				✓ 68		x	0	0					
~~29~~		0	x	x	✓ 69	0								
✓ 30		x	0	x	✓ 70	0								
✓ 31		x	0	x	✓ 71		x	0	x					
✓ 32		x	0	0	✓ 72	0								
✓ 33		0	x	0	~~73~~		x	0	0					
✓ 34		0	x	x	✓ 74	0								
✓ 35		x	x	0	+ 75	0								
+ 36	0				✓ 76		x	0	0					
✓ 37		x	x	0	✓ 77	0								
✓ 38	0				✓ 78	0								
✓ 39		x	x		✓ 79		0	x	0		56	22	22	25



not blue 0

refer to Pages
69 — time 9.03 P.M.

Page 117
11.25 P.M

Page 131
12.10 P.M

TAE

was found to be

Summary Lot 1

The average of all the
91 lamps tested pp. 221—231

Volts	Ohms	Foot lbs
148.	188.2	5282.

That is 300. candles per
obtained per Horse power

Record was kept of 89
lamps the average ~~being~~ burning time 310 minutes
38 lamps were blue at
the clamps. The average
of 27 of these gives

Volts	Ohms	Ft. lbs.
157.	152	5352

TAE

The average burning time of th

88 lamps 22159
No 40 = 1350
" 47 = 1050
" 1 = 745
" 17 = 703
" 90 = 790
" 96 = 706
27601.

~~Average time of burning of 82 Lamps which burnt their Resistance coils.~~

~~[illegible] Minutes~~

Average burning time of 82 Lamps which did not [illegible] of 1st lot from factory

Total No of mins = 22159
" " Lamps = 82

Average = 270 Minutes.

Also 6 lamps which lasted about 700 Mins = ~~[illegible] Minutes~~ which added makes a grand total of = 26359 which gives an average of the 88 Lamps of 299 minutes

82L - 22159
1350
1050
745
703
790
704
183
88L 27601 Total Min,

Average for 88 lamps 310 Min

TAE

Lot 1.

Lamps that broke in the succeeding 50 minutes.

	During the time	Total	%
0 - 50	10	10	11.1
50 - 100	9	19	21.3
100 - 150	11	30	33.6
150 - 200	4	34	38.1
200 - 250	7	41	45.9
250 - 300	8	49	54.9
300 - 350	4	53	59.8
350 - 400	10	63	70.7
400 - 450	5	68	76.3
450 - 500	6	74	83.4
500 - 550	1	75	84
550 - 600	2	77	86.5
600 - 650	3	80	90
650 - 700	3	83	93.4
700 - 750	3	86	96.6
750 - 800	1	87	97.7
800 - 850	0	87	97.7
850 - 1000	0	87	97.7
1000 - 1050	1	88	98.8
1050 - 1300	0	88	98.8
1300 - 1350	1	89	100

Lot No 1

Time	Nos	Perct	Time	Nos	Perct
from 0 to 50 minutes	54 58 49 53 95 68 26 32 24 69 10	$11\frac{19}{21}$ %	from 150 to 200 minutes	56 67 64 79 33	$39\frac{2}{7}$ %
from 50 to 100 minutes	4 37 3 14 39 6 10 12 35 19	$= 21\frac{3}{7}$ %	from 200 to 250 minutes	61 20 30 70 52 78 37 40	$47\frac{13}{21}$ %
from 00 to 100 minutes	72 7 33 13 82 2 8 63 62 76 29	$34\frac{11}{21}$ %	from 2 50 to 300 minutes	100 25 74 83 77 31 42 39 48	JME $57\frac{1}{7}$ %
			from 300 to 350 minutes	46 19 55 96 52	$61\frac{19}{21}$

(over)

Blot on the next Page

torn out by ... Dammy

Nos	Time	Per ct	Nos	Time	per ct
60 41 84		from 500 to 550 minutes	45	74	88 $\frac{2}{21}$ %
65 71 15 51 22 16 21	from 350 to 400 minutes per ct 73 $\frac{17}{21}$ %	per ct from 550 to 600 minutes	75 93	76	90 $\frac{10}{21}$ %
62		per ct from 600 to 650 minutes	90 92 5	79	94 $\frac{1}{21}$ %
38 18 81 50 97	from 400 to 450 minutes per ct 77 $\frac{16}{21}$	per ct from 650 to 700 minutes	36 89 98	82	97 $\frac{13}{21}$ %
67		per ct			
34 85 80 87 43 86	from 450 to 500 minutes per ct 86 $\frac{19}{21}$	from 700 to 750 minutes	91 17	84	100 %
73					

Tal

Tae

48 candles ~~going yet - 745 pm~~

1421 Muffle pretty high - higher than ordinary new way clamping - Vac. high bad spots
4 hours 10 min

48 candles
1424 ditto 3 hours 30 mins - new clamping
no spots - Vac High

48 candles
1382 - gas f corrugation . 1.45 no spots high Vac
old clamping - 1,45

32 candles
1427 = Muffle f = higher than ord - bad spots high
Vac - new clamping - 2 hours 13 min -

48 candles
1384, Gas furnace - no spots split in clamps =
going yet 745 pm - built very much.

48 candles
1395 = Gas furnace — 2 hours 13 minutes clamped old
no spots - high Vac - : lasted 2.13

32 candles -
1428 - muffle high heat - bad spots high Vac.
Corrugated clamped new way - 3 hours

32 candles
1380 - Gas furnace - old clamping, no spots
high Vac - on yet 750 -

32 c
1360 ~~Co~~ Gas furnace - Corrugated till
touched glass - no spots split in clamps
Vac 95 old clamping 1 hour 35 min -

32 c
1435 - Muffle high heat - clamped new way - German glass = no spots - not bent - good = on yet 752 - pm -

32 c.
1420. Muffle high heat - new way clamping
bad spot - high Vac - 2 hours 20 min

32 - c
1406. Muffle intense heat - old clamping
glass buckled, no spots high Vac
3 hours

48 c
1433 - muffle high heat - bad spots high
Vac 1 hour 15 min.. new clamping

32 c
1410 ~~Muffle~~ Gas furnace then put in Muffle at intense heat 11 minutes - high R - bad Spots

TAE

Summary of Lot 1 TOE

The average of all the lamps tested (91) to be found on pages 221 to 231

Volts.	Ohms.	Foot-lbs.
148.	188.2	5282

That is 300 Candles per Horse Power were obtained

From the record kept of 89 lamps the average time of burning was found to be 310 minutes

Thirty-eight (38) lamps were blue at the clamps the average of 27 of these gives.

Volts.	Ohms.	Foot-lbs.
151	152	5352

Nothing important on next 2 pages
torn out by Hammer

minutes
82 / 22041
268 average for 82 lamps of Lot 1

2.2041
1350
1050
745
703
790
701
103

89 / 27483
minutes
308 average for 89 lamps.

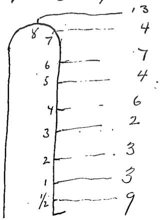
TR

Average time of burning of 32 lamps in first test which burnt their resistance 198 minutes.

On page 249 is the table showing the number of lamps that gave out during the succeeding 50 minutes.

On page 219 is an analysis of the places at which the lamps broke

51 lamps



TAE

On page 243 is
a table showing the
lamps that showed
blue at the clamps

TAE

Result.

These lamps were made with very poor vacuums and in a number of cases the sealing of the wires through the glass was defective. The wire was simply run through the glass of the inside part which was sucked in.

The lamps that TV9 lasted the longest were those which took below the average E.M.F. to ~~bring them to the~~ 48 candles.

Lamp. 40 which lasted 1350 minutes showed at the end of that time no

slackening on the clamp
It was tested twice for economy and was found ~~the~~ to be a fraction less economical at the end of the test than at the beginning though practically the same. The resistance and E. M. F were also practically unaltered. This shows that when the lamps are sufficiently exhausted that they are permanent.

All the lamps that were blue at the clamp at the beginning of the test gave out before 700 minutes.

TAE

Lot 1 – Test lamps.

No.	Volts	Ohms
16	133	177
17	145	179
18	141	193
19	123	188
20	199	213
~~21~~	~~too high~~	
22	120	168
~~23~~	~~[illegible]~~	
~~24~~		
25	122	180
26	132	269
29	128	177
30	127	166
31	155	223
32	141	206
33	136	194
34	126	197
35	157	232
15 lamps	2077	2962

Volts

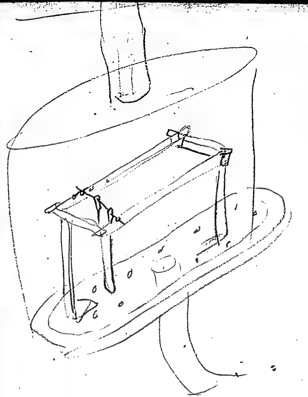
15 | 2077 | 138
15
57
45
127
120
7

15 | 2962 | 197
15
146
135
112
105
7

197 Ohms

138 Volts

TAE



TAE

2 2

33) 2850 (8.6
264
210
198

33) 267 (7

33) 250 (7
231
19

33) 267 (8

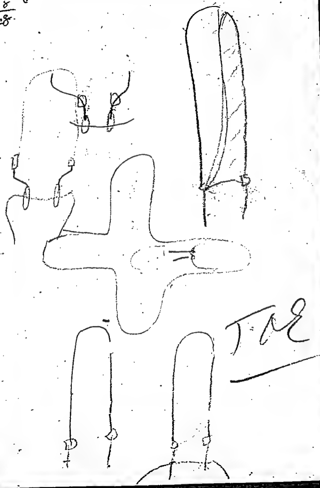
33) 258 (8

21.6
8.6
129 6
1728
185.76

21.6
7
151.2

21.6
8
172.8

33) 258 (8



Menlo Park Notebook #112 [N-80-07-23]

This notebook covers the period July-August 1880. Most of the entries are by Francis Upton. There are also a few entries by Edison. The material relates mainly to tests of carbon lamps. Included are a few notes and a table relating to faults that were found in the lamps, based on the experiments recorded in Notebook #103; notes and occasional drawings relating to tests of six-inch bamboo carbon lamps, along with a table of results; and a record of bets among the laboratory staff on the life of the lamps being tested. There are also notes relating to the burning of kerosene lamps in order to determine their cost; and notes on conductors, dynamos, meters, lamps, and wiring for the Menlo Park distribution system. The label on the front cover is marked "Upton" and "Lamps." The book contains 284 numbered pages.

Blank pages not filmed: 4-5.

6" Bamboo Table p. 163

Page 69 - 75 - 87 - 123 - 125 - 131 - 133 - 137 - 145 - 149

Kerosene oil test p 213

Kerosene at 22cts per gallon cost 80cts per M

1300
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
7
8
9
20
1
2
3
4
5
6
7
8
9
30
1
2
3
4
5
6
7
8
9
40
1
2
3
4

1345
6
7
8
9
50
1
2
3
4
5
6
7
8
9
60
1
2
3
4
5
6
7
8
9
70
1 227
2 225
3 233
4 241
5
6
7
8
9

1380
1
2
3
4
5
6
7
8
9
1390
1
2
3
4
5
6
7
8
99
1400

TAE

Questions

Does a lamp appear to give more light in the evening than in the day time?

Does a lamp change its resistance after it has been brought up once very high?

The relation between the the temperature of the lamps and their permanence

Try a number of lamps very high on pumps

THE

Lasted

[illegible] 101 minutes

Bast lasted minutes	Paper	Bamboo lasted minutes
9	3 minutes	$11\frac{1}{2}$
14		9
2		1 hour – then took away
2		22
13		52
7		2
1		1
12		5
5		1
2		2
		26

TAE

11 131

at Candles	Ohms	Ohms
15.5	146.9	108.3
16	142.4	
15.5	127.6	122.9
		112.9
16.	109.6	97.1
17.5	125.1	114
16	140.9	120
15.5	129	111.4
16	118.1	104.9
		91.2
17.5	99.1	89.4
16	160.4	145.4

Results from Book 103

	page	ft. lbs	Lasted
Bamboo	255	3900	26 minutes
Bamboo	231	4150	5
Bamboo	225	430	12 m
Bamboo	217	4356	5 2 1/2 m
Bast	199	4640	7 m
Bast	239	4670	5 m
Bast	235	4900	12
Bamboo	209	4950	60 m
Bamboo	213	5010	22 m
Bast	195	5080	1.3 m
Bamboo	139	4030	9 m

Results over

TAE

TAE

A low resistance lamp with high economy lasts well.

A low resistance lamp with low economy shows some fault in cutting

The life of a lamp depends entirely on the weakest spot, and the lamp always breaks at the ~~ue~~ spot~~s~~ which shows at low red the brightest.
The blue in a lamp depends on the highest

temperature of any part
of the carbon and an
internal area

THE

Lamp 1307 July 23. 1880

coarse ~~~~ bamboo

Good carbon

16 candles

6290
6290
6250
1500

20330
1011.6

TAE

Traces of blue

11-10 48 candles

6290
6290
6200

18780
939

11-32 blue disappeared

12- Engine stopped page 19

Estimate 6 inch lamps

July 28th 1880

10 candles 2700 ft lbs
$\underline{1350}$
15 candles 4050

Practically 8 per H.P.

TAE

Lamp 1307 from page 15
coarse bamboo

burned 50 minutes

1-57 Started
48 candles

2,15 Busted 68 Minutes

TAE

Lamp 1316
amaranth

very bad spot -
did not go to.
48 candles

TAE

Lamp 1304
Bamboo

	Very good carbon
2-42	Started Reversed current
4-16	Went very rapidly

1.8
66
60
94 minutes

TAE

Globe darkened

[illegible]

540 [illegible]

13.2 per HP

No. 1308 Bamboo
Made from coarse fibre

Resistance Cold

6290
6250
6250
6290
6270
2100

YAE

Very even except towards one clamp dark

8 candles

6250
6290
6290
2100

20930

104.6 Ohm

2.30

76.6

No. 1308
Coarse Bamboo

16 candles

250 = Ω

6250
6290
6290
2000
20830
10415

THE

No. 1308

5-12	Reversed the current to Comp very fast
5-37 12 25	stopped THE for motor
A.M. 9-30	Started 48 candles
954	24 25 49 minutes

No 1310

Jap bamboo

Very poor carbon

TAE

Lamp 1304 mid point proof

Bamboo TAF

	Good carbon
1-35'	Started
	Hear fuse of magnet so as to do away with blue
2-35	broke

No 1239 V 113
Wound with wire

~~5400~~
~~5,4 Ohms~~ / 169

~~147 = D~~

~~6290~~
~~6290~~
~~12580~~ Ohms

The blue could not be made to disappear. Tried magnet on carbon could by placing the globe in a certain position cause the blue to disappear entirely

1.55515
1.5515
1.6464
5.9031
3.6525   4500
4.5185

3
.8660 7.5 per H.P.

Lamp No 1323 July 24th 1880
Heated to white
in Kerosene

16 candles
107 = D
35.6

12.58 Ohms 78

67.5 inches

126 = D
4

6290
3800
10.090 Ohms

5-55 Took off current

4.0157
2.1945
1.8242

66. ft lbs

4416 1.6493
1.6493
1.6464
9.0737
4.0187

10.400

65.745 1.8145
14.75 1.1688
.6457
2

19 1.2914
0.9031
156 candles 2.1945

No 1323

80
26 3/4
53 1/4 TLS.

Kerosene oil lamp
8 candles

9-37 65.¼ inches

134
4416

6290
2150
8440

7 $\frac{49}{8}$ 5

392 candles per H.P.

1.7267
1.7267
1.6464
9.1477

4.2425

17.50.0 ft. lbs

~~2.44~~

~~4.2425~~ 4.2425
~~2.1761~~ 2.5441
~~2.0664~~ 1.6984

50 ft lbs per candle

No 1323 Thos A Edison
July 26 1880

9-48 Could not measure very easily but estimated 350 candles

7.2 Ohms

$\frac{160}{53.3}$ Volts.

10-1 Went at top of carbon 13 minutes

Bast No. 1324

Incandescent for a short time in oil TAE

Book 137 p 53

Resistance cold 135.4 Ohms

16 candles

86.9 Ohms

71.6 Volts

2620 ft. lbs.

12.5 per H. P.

No 1324

July 26. 1880

3.2 48 candles

.6290
6290
3720
16300
81.5 Ohms

83.3 Volts

8760 ft lbs.

8.75 per H.P.

3.37 ~~Went chan~~
stopped machine
35 minutes

No 13 24

4-53	Started
5-01	

HNE

2.0481
2.0481
1.6464
7.6747

3.4173
4.51685

1.1012

2600

12.6 per H.P.

No. 1 3 2.5
manilla fibre July 26 - 1880

16 candles

1335 = 1111.6

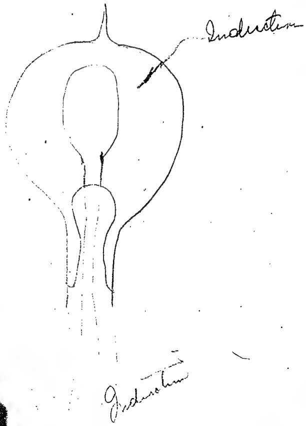
6290
6290
6250
6250
6290
6290
4760

42360

216.6

Thomas A
Edison

broke at clamp



Lamps

fixed with induction coil.

16 candles
6290
6250
6250
6290
6290
4500.
35870
179.35 Ohms

TAF

The vacuum gave—

273
272
54.5.
amp 128.5
20
1.08

91.6 Volts

4430.

1.08

2.7364
7.8911
1.3010
0.0334
1.9619
1.9619
1.6464
8.076
3.6464
.6018
.0346

Calor & Galva July 27. 80

2-15 Temp air 83°3 F

2-48-3 70.9 F

273

94
70.9
231

124580
4,200
16780
83.9 Ohms

TAE

272
20 cells

64.5
64
128.5

2-53 89°F
2-57 94°F

4542
9494
48

1132
5 split
1137
247.5
8905
20
910

TAE

7.9599
0.3432
2.8893
9.0458
1.3636
3.6018
48
5970

23.1

4000

497 2.6964
Lamp 129.5 7.8877
Cov 20 1.3016
1.06 0.0253

9.2140

1.9104

8 | volts 1.9104
1.1646 4
120.15 7.9205

3.3877
2440 ft. lbs.
4.5185

1.1308
13.5 per H.P.

Lamp No 1327

New mould Jul. 27.80

16 candles

247
250
497
188.830
5 300
241 30
120.15 Ohms

TAE

66 20 cells
63.5
129.5

2 7627
9.2140
1.9767
1.9767
116464
7.9568
3.5566

3600

3.600
4.5188
.9619

9.1 per H.P

Lamps No 1327

3-44	48 candles
	291 288 579
	18830 3300 22130 TAE
	110.6 Ohms
4-51 3.44 1.07	bursted at 4.51

2.7752
9.2140
1.9892
1.9892
1.9892
1.16464
7.8962
3.5210

97.5 Volts.

3300

Lamp No 1328 Feby 28

New Mould

16 candles

25080
350
25430
127.15

296
300
596 Lamp

66.25
63.5 20 cells
129.75

cracked in the glass around the clamps.

2.6866
9.2140
1.9000 79.5
1,9000
1.6464
8,0083
3.4547 2850
4.5155
1.0638

11.5 per H.P.

Lamp No 1322
Real Bamboo

16 candles

245
241
486

6250
6290
6290
800
19630
98.1 Ohms

TAE

2.7419
9.2140

1.9559
1.9559
1.6464
9.9017

3.4599 2880
3.5185

.0586

11.5 per H.P.

Lamp No. 1328
Good vacuum

16 candles

27.2

25080
1254

TAE

280
272

7.52

67.5
61.5

1290

2.8075
9.3140
2.0215
2.0215
1.6454
7.6459

3.3353
log 2 = 0.3010
3.6363 4330
4.5185
.8822

7.6 per H.P.

1-43 48 candles

18830
3770
22600
113

TAF

318
324
642

1.57 ½. Went out.

150 2.1761
2.1761
1.6064
7.7258

3.7244

530 Wrong

No 1337 July 29

6 inch length

16 candles

43 R
44 L
87

305
302
607

AE

$\underline{|37.660}$
188 Ohms

68 5
11 5
5 9

18357
.10607
17750
2
1.55500

35.5
2
71

$$\frac{66 \text{ candles}}{(80-x)^2} = 66$$

48
24
7 2

$$\left(\frac{80}{80-x}\right)^2 = 66$$

$$80^2 = 66(80-x)^2$$

TAE

12 70 10

49
2
98

68 1.8325
12 1.0792
7533
2
1.5066

66

39.5
2
79

69 1.8388
11 1.6414
7984
2
1.5966

534 2.7275
8.1870
1.08 0.0334
20 1.3010
2.2490
177 2.2490
1.6467
7.9696
3.9140

8200 Wrong

No 1337
16" long Bamboo

At 68.5 inches
6-~~7~~8 Started

31370
2800
34170
17°. Thus

265
269
534

35
30
65

TAE

Lamp 1337
6" Bamboo Drawn in sliding mould

6-18	Started 68.5 inches on bar or 71 candles
6-45	Blue disappeared
7-20	62 minutes

TAE

Standard cells
made July 30 1880

Lamp No. 1238
Bast clamped $V = 108$ very light

---

16 candles
Bad spot
TAE

1,8976
1,8976
1.8464
8.0048

3.4464 2600
4.5185

1.0721

11.8 per H. P.

~~Lamp No. 329 New mould Bamboo~~ July 30

Olderbau No 1322

~~Vacuum pump~~

Real Bamboo 16 candles

238 63.5
235 66

79

18830
950

19780

98.9

TAE

1.9206
1.9206
1.6454
8.9018

3.4894 3080
4.5185

1.0291

107

Lamp 1331
Wax mould [illegible]

$\frac{250}{83.3} = D$

18830
1100

19930
99.6

1.9605
1.9605
1.6464
7.9814

3.5488 3540

Lamp No. 1332

went at clamp

Lamp No. 1336
vacuum gone

~~Lamp~~ No 1333
18,830
2.050

20 880
1 B 4.4

127 ~~6~~
91.3

TAE

Lamp No 132

Regular

6.69 0.8254
~~2.06~~ 1.3345
144 volts 2.1599
2.1599
1.6464
7.6183
3.5846
3800 4.5185
.9340

8.5 per H.P.

No July 30, 1880

6" carbon

333 .16 candles
336
669

376.60
105.00
481.60
240.8 Ohms

49.25
50.75
100.00

Lamp in Kerosene vapor

2 candles

185 = Δ

~~4850~~
4500
22.5 Ohms Wrong

Tai

1.8573
1.8573
1.6464
8.7570
4.1180

13.000

About 16 candles

$\frac{215}{72.5}$

$\frac{3500}{17.5}$

Wrong

TAE

2.4757
8.0875
0.0334
1.2015

1.8976
1.8976
1.6464
8.0342

3.4758 2999 ft. lbs.

The lamps in the calorimeter covered partially with shellac

Temp H_2O 69.37
air 84°
14.7
48.2

4-30

1-45

Started

300 299
298 297

81 T.R. 81.75
82.5

12500
5900

18480
92.4

100
69.3
30.7

2 - 2 Stopped. 100° F

Total Wt Vessel

1102 Grms.
247.5
954.5
20

974.5 $\bar{1}$.9888
0.3432
2.8893

Const. $\frac{JKg}{T}$ 8.7696

1.9909
1.4871
2.4780

3000 ft lbs.

Paper in Florence

16 annees

5700
2811 Livres

148 =

TMG

1.9460
1.9460
1.6466
5.0438

3.5822 3820
4.5185

.9363

.8.6 per Horse power

6" carbon in Gasoline vapor

16 candles Amadiode

12550 19 candles 45°
.5600
18180
90.4

1265
88.3

TAE

1.8976
1.8976
1.6464
8.0031

3.4447 2780.

Samp No. 1322

% 37 =
79

18830
1.040
19870
99.35

TAF

1.9805
1.9805
1.6464
7.9848
3.5922
4.5185
.9263

3910

8.44 per H.P.

Lamp No. 1343 Aug 2. 80

6" Bamboo heated in gasoline

Resistance cold

18830
7300
26130
130.15 Ohms

287
287

64.5
65

95.6

18830
1900
20730
103.6 Ohms

1.8633
1.8633
1.6464
8.0245

3.3975

1.5727
1.5717
1.6464
8.0264

3.4182

2500

2620

	Volts	Ohms	H. lbs
page 78	79	98.9	2800
100	~~79~~	99.35	2780
104	73	94.5	2500
	74.6	94.1	2620

Lamp No. 1322

6" Bamboo in gasoline August 2

16 candles

219
218

73

18830
100
18915
94.5

224 / 74.6
18830 / 94.15

TAE

Aug 2

Lamp No 1343
6" Bamboo in gasoline

Very bad: spot below which has increased since the lamp was tried a short time since; blue on clamps

292

18830
1850
20780
1039

Lamps no   Aug 2

paper in kerosene vapor

---

16 candles

139 = Δ

$$\frac{5390}{26.9}$$ Ohms

TAE

11-3 | 68" 51 Started

350

12 580
6 340
18 920
94.6 Ohms

11-7 | Went TAE

Aug 2, '80

2-4 Temp air 87°.37

2-20 71° F Temp water

268 = 0

18830
800
19630
98.15

Temp. test

2.77
118.5

2.11425
7.9264
0.0334
1.3010
.92608

50.5
49.6

1.7033
1.6981
1.6468
8.5918

.4360

3.6394
3.6263
0.0133

1.03%

Lamp No 1342 Calori[illegible] Galva

Paper brought up in kerosene

2-36 Temp H_2O 74.7 7

87.3
74.7
12.6
87.3
99.9 7

(5120
25.6

150 65 99.7
148 65 74.7
25.0

Machine Batteries
277 120
277 177

-45 Stopped 99.7

Calos I Gabra

Wt vessel &c

1119
.247.5
871.5
20

0.891.5 $\bar{1}$.9501
0.3432
2.8893
comp 9 9.0458
1.3179
4230 3.6263

2.4472
9.2608
1.7080
1.7080
1.6464
8.5935
4500 3.8559
3 6368
.0191 1.045 %

1152
245
907
20
.927

T.9671
0.3432
2.8893
8.9586
1.4786
3.6368

1023
72.2
30.1

Calor Galva

3-4 72°.2 F Started

87.7
72.2
15.3
87.5
1028

TAF

20 cells
120
117

280
280

15100
25.5

3-15 102°.3 F Stopped

1152 Grammes

278.5

2.4448
9.2608

1.7056
1.7056
1.6464
8.5910

4450

3.6486
.6373

.0113

1124
245
879
20
899

$\bar{1}$.9538
0.3432
2.8893
9.5 9.0223
26.8 1.4287

3.6373

Galv 1,025% greater than
Calor

Lamp outside coated with
tar

2-54

74° F

78) 4600.000 (40
312
1480.

875
74
133
873
1006

~~4,600 000~~

TAE

280
277

(5130
25.65 Ohms.

2^h-53'-30" 100°.8 F

100.8
74
26.8

1124

2.8092
7.8901
1.3345
2.0338
2.0338
1.6464
7.8172
3.5312
4.5185
.9873

3400

9.7

6" Bamboo

No. 1346

16 candles

25080
6100
31180
155.9 Ohms

TAE

325 322 63
320 322.5 65.75
5445 128.75

2.8000
7.9914
1.3345 9.3259
2.1259 133
2.1259
1.6464
7.8573
3.7555 5700
4.5185
.7630 3.18 per H.P.

3.7555
71 1.8513
1.9042 80 ft lbs per minute

.7630
1.8513
2.6143 412

6" Bamboo Aug. 2

No. 1346

8-15 | 68".5 on bar

318
3.4
3.7
631

.53
49
102

25080
2710
27790
138.9

JAE

8-22 | Stopped
8-24 | Started

~~9-17 Edison~~
~~9-25 Batch~~
9-30 Hughes
~~9-10 Upton~~
~~9-18 Böhm~~
~~9-16 Martin~~

Pool closed

Bate ~~bets~~ $1.00 ~~$1.00 that~~ Hughes
does ~~not~~ not win
with Hughes
Hughes bets that Batch
~~Ba~~ does not not win 50cts
Batch bets $.50 that it
does not last until 9-3
taken by Hughes

~~Edison bets $2.00~~
~~that lamp does not~~
~~last until 9-45 P.M.~~
~~with Hughes~~

Martin took 50 cts for his chance

~~Upton 9-45~~
~~Batch 9-50~~
~~Hughes 10-15~~
~~Edison 10~~
~~Martin 10-20~~
~~Hughes 10-25~~

Pool closed
Pool closed

Batch bets $1.00 that
Hughes does not win
Hughes bets $2 to $1 that
it last until 10-20
Batchelor

Hughes bets $3.00 to $2.00 that the Camp lasts beyond 10-30

~~[illegible]~~
Hughes 11-15
Watson ~~11-30~~
Batch 10-45
~~[illegible]~~
11-30
11-45

~~[illegible]~~
Hughes 12-
Batch 12-15

closed

Hughes 12-30
Batch 12-45
1-
Hughes 1-15 $3.50

See

Batch ~~500~~ bets ~~that~~ $1.00 to 5.00 that the Camp won't last until 3 A.M tomorrow morning
open to 12

Hughes ~~bets that~~ [illegible] that the Camp lasts [illegible] 2 A.M. Watson Upton

Hughes bets \$1.00 that Butch does not win the pot and that he wins

~~Hughes bet \$10 that the Camp will ~~cash~~ cast until 2~~

Upton bets ~~\$10~~ to \$1.00 that it will not cast until 3. A. M

Taken Hughes

3^h ~~30'~~

11^h 40'-30 Went

Lasted

3^h 28'

208 minutes ~~169~~

9.3259
2.4393
1.7652
0.3010
2.0662 116 volts
2.0622
1.6664
7.7922
3.5670 3690
4.5185
9515 8.9 per H.P.

Lamp No 1345 Aug 2 1880
6" Bamboo

16 candles

1275

25080
7200
~~1833~~
32280
161.4 Ohms

6к,5

330

2.4290
.3010
9.3259
2.0559
2.0559
1.6000
7.8111
3.5693 3710

16 candles

3400 ft. lbs
3690
3000

4.5185
3.5693
9492 8.9 per H.P.

Lamp No 1348

6" Bamboo

16 candles

263

25080 [illegible]
5810
30890
154.45

2.5250
0.3010
9.3???
2.1519
2.1519
1.6?5?
7.8636
3.?738

141 Volts

6510

4.5185
3.8136
.7047

5 per H.P.

Aug 2. 1880

12-10

68"5

335 = ?
25000
2310
27390
136.9

? Col

$1.00
Batch ~~bets~~ that it will not last until 1-40 A. ~~M~~ Taken Hughes.
Same with Upton
Batch & Hughes repeat above bet,

1st Pool, on Lanes 1 3 & 8

Upton 1

~~Batch 1-15~~ closed

Hughes 1-2.0

~~Batch 1-2.5~~

2d Pool,

1 Batch

1 30 Upton

2 Hughes

Hughes

1-47 Went

1-37

47 minutes

~~3,3,040,000~~

1100

30

~~20~~
12000

12
3.14

~~14~~ 3.000

2.8062
8.0292
1.3139
2.1493

141 Volts

Machine on pumps

315 = D
325
640

49
44.5
9 3.5

TAE

141 Volts on line

318
318
320

290
47
133 Volts

2,4624
8.3279
1,334 5
2:1248
2.1248
1.6464
7.8359
3.7319

5400

133 : 147 :: 1459

2.1492
2.1671
7.8761
2.1894

15480hm
1459
8.6

6" Bamboo see page 132
No 1345

66.5
13.5

1,8228
1.1303
.6925
~~.3010~~
1.3850
.3010
.6860

48.5 candles

6" Bamboo

~~4 Ca?~~

46 candles

290 = D
292
288
286

47
47

1/2 hour

25080
4100
29180
1459

Aug 3d

68"	1.8325
12"	10792
	7533.
	2
	1.5066
	3010
~~[illegible]~~	1.8066

64 candles Put on pump line at 3-55 P.M. clock up stairs J.W.

Ran 2 hours 15 minutes

Engine ran too fast and brake it.

2.6758
8.0254
1.3345 — 93599
2.0357 — 108
2.0357
1.6464
7.8487
3.5666 — 3600

Lamp No 1346 Aug 3 1880
6" Bamboo FRU.

Good carbon
16 candles

237 46.3
237 48
474 943

25080
3220
28.300
141.5 Ohms

TAE

271 | 320 || 134.5

2.1286
2.5051
7.5670
2.2007

158.7
134.5
24.2

16

5.43

2.7348
9.3599
2.0947
2.0947
1.6464
7.8714
3.7072

5400

Lamp No. 1346
6" Bamboo

68"   48 candles

271
272
543

25080
1820
26900
134.5

TAE

Went 20 minutes on
Photo room then up stairs

26848
9.3599

2.0447
2.0447
1.6464
7.8242

3.5600 3630
4.5185

.9585 9.1 per H.P.

Lamp No. 1349 Aug 3 1st run
Aug 3.80
6" Bamboo

16 candles
Good lamp

242
242
484
25080
3,00
28180
140.9

TAE

283 : 320 :: 131.4 :

2.1185
2.5051
7.5482
2.1718

148.5
131.4
17.1

2.7520
9.3599
2.1119
2.1119
1.6464
7.8815
3.7517

129
129

5640

Lamp No 1349

48 candles

283
284
565

5-P.M. 25080
1200
26280
1314

2.7292
8.0245
1.3345
2.0882 122
2.0882
1.6464
7.7253
3.5481 3530

Lamp No 1351

6" Bamboo.
Selectia.

16 candles

268
268
536

46
48.5
94 5.

31370
6200
37570
187.8 Ohms

48 candles

$$\begin{array}{r} 31.370 \\ 3000 \\ \hline 34370 \\ \hline 171.85 \end{array}$$

AT

No 1347

6" Bamboo Bad spot

~~Of~~ 8 candles

went in about five minutes

TAE

97
62
208
1367

510
197
420
360
1487
372

	132	161.4	3690					
	136	154.4	3710			136.9	6510	Lasted 97 minutes

6" Bamboo Summary

		16 candles		48 candles		71 candles		
	Page	Ohms	Ft lbs	Ohms	Ft lbs	Ohms	Ft lbs	
	69	188				170		Lasted 62 minutes
	87	240.8	3800					
Good	123	155.9	3400			138.9	5700	Lasted 208 minutes
Good	153	140.9	3630	131.4	5640			
	157	187.8	3530	1768				about 5 minutes
1352	165	151.4	3660		h 178 5140			
	175	152.6	3500		h 180 4720	4720		Lasted 510 minutes
	184	137.2	3560	126.7	5400			Lasted class 12 minutes
	188	151.5	3640	1399	5550			197 minutes
Poor	192	181	3620	161.3	6000			few minutes
	204	178.1	3610	161.6	5150			four minutes
	208	156.8?	4100?					Very ... bent carbon
		166.9	3370	158.7	4890			420 minutes
	220	216.6	3220	195.6	5180			Touched the glass
Poor carbon	224	233.1	3440					
			4560					

T69

over

2.6902
8.0241
1.3345

2.0488 — 9.3586 — 114 Volts

2.0488
1.6464
7.8199

3.5639 — 3660

From page 163

	16 candles		48 candles		
1371 p. 228	165.9	3790	151.9	5430	
1373 p 232	166.3	3760	149.9	5380	Good lamp 360 minutes
1373 p 236	158.6	3650			
1374 p. 234	164.1	3670	156.1	5040	
1376 p 244	238	3600			

Lamp No 1352

Selected 6" Bamboo

16 candles

246
244

490

46.5
48.1

94.6

250.80
5200

30280

151.4 Ohms

[illegible] at 16 165 Ohms
[illegible]

Average [illegible].
3580 for 16 candles

TAE

2.5185
4.3586
1.8771
1.8771
1.6464
7.7699
3.1705

75 Volts

1480

6" Selected Bamboo properly
0.012 X 0.012

1 Candle

165 R
165 L
330

TAE

8900
25080
33980
169.9

2.5587
9.3586
————
1.9173   82.6 Volts
1.9173
1.6464
7.7802
————
3.2612   1820

4.5185
3.2612
————
1.2573   18.1 per H.P.

6" selected Bamboo   G.P. H.

2 candles

182 L
180 R
————
362

25080
8100
————
33180
165.9

TAE

2.6021
9.3586
1.9607 91.3
1.9607
1.6464
7.7908
3.3586 2280

4 Candles

200 R.
200 L.
400

TAE

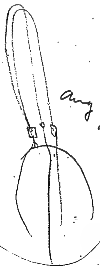
25080
7300
32380
161.9

2.6435
9.3586
2.0021
2.0021
1.6464
7.8065
3.4571   2865

100 Volts

Ho

81 : 110 :: 6
6
81)660(81
648
120



aug 16 1880
Zkw

No 1852   Aug 3'80

8 candles

220 10
220
440

TAE

25080
6250
31330
156.65

2.6821
9.3586
2.0407 110
2.0407
1.6464
7.8164
3.5742 3500

It takes a ~~8~~ ft. lbs to give 2 candles
& b " " " " 12 candles
with same surface and curve
Surface = m gives 2 candles
Surface of another lamp = n
to give 12 candles what ft. lbs required

No 1352 — Aug 3d 1880

About 9-P.M. 16 candles

240
242
240
481

45.5
49
94.5

TAE

25086
5350
30430
1526

2.7308
9.3586

2.0894
2.0894
1.6464
7.8404

3.6656 4630

Probably wrong

269
2

538

TAE

3800
35080

28860
144.4

2.7482
9.3586
2.1068
2.1068
1.6464
7.8511
3.7111 5140

2.7364
9.3586
2.0950
2.0950
1.6464
7.8621
3.6985 5000

67 1.8261
13 1.1139
.7122
2
1.4244
.3010
1.7254

3 candles

1352 Aug 3-81

48 candles

280
560

9.16
3100
25080
28180
140.9

TAE

9-30 67" on bar
275 274
270
545
25080
2400
27480
137.4

50
44.5
94.5

2.7259
8.0223
1.3345
2.3827
2.0827
1.6464
7.8621
3.6739
865 2.9370
321 2.5065
562 2.7497
744 2.8716
11.0648
5.5324
116,100,000,000

340,800

9.3568
121

4720 ft. lbs.

No 1335-2

aug 4 8 A

9:5 A.M.

66".5 on bar

262
270
532

47.5
47.5
95.0

25080
2400
27480
137.4

TAE

The bad places in the carbon have increased since first last evening

25080
2350
27430
137.15

265
268
533

5
2
7

At 6 P.M. 8 hours 15 minutes
went 15 minutes more

8 hours 30 minutes
480
516

Pump line
Aug 4

315
318
633

533 : 633 :: 137.15 :

2.8014
2.1372
7.2733
2.2119

TAE

163
137.15
2581

12 feet 24.5 8 hours

Lamp 1352 feet on
pump line at 48 candles
with 1 hour 15 minutes
Time

9.3568
26646
2.0214 105
2.0214
1.6604
7.8627
3.5519 3560

Lamp No 1355

6" Selected Bamboo

Very good carbon
16 candles

TAE

25.080
2370
2)27450
137.25

234
228
462

531 ; 633 :: 126.7

2.7028
2.8014
7.2749
2.1791

151
126.7
243

2.7251
9.3568
2.0819
2.0819
1.6464
7.8972
3.7074

5.400

48 candles

TAF

264
262
268
531

25080
270
25350
126.7

Went in 12 minute in the glass

2.6902
9.3568
2.6470
2.0470
1.6464
7.8210
3.5614

3640

No 1354

6" Selected bamboo 0.012 X 0.012
Very good carbon
16 candles

248
242
490

TAE

25080
5220
303 00
151.5

580 : 633 :: 139.9 :

2.8014
2.1458
7.2366
2.1838

152.5
139.9
12.6

580 2.7634
9.3568
[illegible]2
.02
1.6464
7.8542
3.7410 5550.

No 1354

48 candles

TAE

287
293
580
25080.
~~2980~~
29980
139.9

46.
49. (20 cells
95

11.38
22
2.55
3 hr 17 minutes

197 minutes

535 2.7284
9.3568

2.0852
2.0852
1.6464
7.7416

3.5584 3620

No. 1353

6" Selected bamboo

Irregular at low red
dark places in middle
of side
16 candles TAE

265
270

535

.31370
4900

36270

181.35

2,8129
9.3568
2.1697
2,1169
1,6464
7.792/5
3.7783

6000

48 candle
Blue at clamp.

3.20
3.30
6.50

TAE

31370
900
32270
161-35

Went in few minutes

4600 000
78
36 800 000
322 000 000
358 800 000

78) 4600 000 (58
390
700
624

7

78

460

88) 4600 000 (4
352

(1

1.800 000) 2660 000
1 8
8
2 69

Aug 4 1880 1-30 P.M.

Pump Line

300
307

48.5
45.5
940

Put in one plug in magnet line

313
317
630
31.6
31.4

TAE

2.4997
8.0269
1.3345 9.3614
72.6 Volts
1.8611
1.8611
1.6464
7.9700
3.3386 2180
0.8451
.4935 311

Lamp No. 1339

7 candles
156 L
160 R 94
316

18830
2600
21430 TAE
1071

Lamp No. 1331

6 3/4 candles

156
157
:

18830
1470
20300

TAE

No. 145~~6~~

Direct on pump line

~~48 smaller~~

69
11

1457
65.75

page 208

	2.10807
	2.10807
	~~7.16464~~
	7.7494
3610	3.5572

Lamp No. 1366

6" Bamboo from gas furnace

16 candles

262
262
524

47.5
48.
95.5

31370
4250
35620
178.1

TAE

603 ; 633 ; ; 161.6 ;

2.2088
2.8014
7.2197
2.2297

169.7
161.6
8.1 4 ft

603 2.7803
9.3568
2.1371
2.1371
1.6464
7.7717
3.7123 5150

Lamp No 1366
6" Bamboo

8-30 48 candles

303
300
603

31370
950
32320
161.6 Ohms

Lasted four minutes

AE

9.3614
2.7193
2.0807
2.0807
1.6464
7.8047
3.6125
4.5185
9060

4100

8.05 per H.P

No. 1367

6" Bamboo

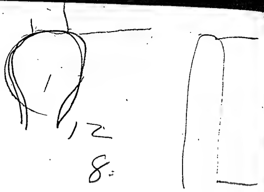
16 candles

262
262
524

31370
156.8 Ohms

95.5

Probably wrong TAE



12

8

10.5 candles for 250 ft lb

16
1500
250
4000
8
32000

12

116
5.66
1 0 1/3

3030
-1515
4545

4.5185
.6571
8614

7.3 per H.P.

16
8
128

4.5185
2.1072
2.4113

257 ft. lbs per candle

2750 3.4393
12 1.0792
229 2.3601

~~2225 3.4509~~
~~13 1.1139~~
~~2.3370~~

~~267~~

2625 3.4191
10.5 1.0212
2.3979

250
29
1475
2950

2950 3.4968
9.5 0.9777
47 5191
2

90 1.9542
1.6 0.2041 1ct
56 hours 1.7501
2000
11 1000
16. 1.2041
8. 0.9031 1ct
7.5. 0.8751
2.9823
1.0419
$\bar{2}$.0591

.0114 Gallon

$\frac{1}{90}$ gallon per hour

220 1.3424
2.0591
$\bar{1}$.4015
.2041
.252 $\bar{1}$.6056

.4 1/4 ct per hour
for 10 candles.

Kerosene oil lamp

22. fluid oz of
kerosene in lamp.

Started 10-3 by
my watch

10-10 | 8 candles TAE
1-37 | 11 candles
5-25 | 9 candles
5-40 | put out and
| 11 oz left
| 7.5 hours

407 2.6964
9.3568

2.0522
2.0522
1.6464
7.7776

3.5284 3370

Lamp No 1367 6" Bamboo

a slight spot on one side but a very good carbon Bent over nearly ~~tuching~~ the glass

16 candles

252
245

497

52
47.5

94.5

51
43.5

7.5

25080
8300

33380
166.90

Hung (Lamp.

Jae

582 : 630 :: 158.7 :

2.1992
2.7993
7.2351
2.2336

171.2
158.7
12.5 6' 1"

2.7649
9.3568.
2.1217
2.1217
1.6464
7.7995
3.6893

4890

1367

48 candles

295
287
582

25080
6670
31750
158.7

On pump line
7 hours 6
60
420 minutes

Lamp No 1368
6" Bamboo

Very bad spots N.G.

TAE

2.7419
9.3568
2.0987
2.0987
1.6464
7.6643
3.5081

3220

Lamps No 1369
6" Bamboo

16 candles

280
272
552

37660
5670
43330
216.6

TAE

2.8228
9.3568
2.1796
2.1796
1.6464
7.7087
3.7143

5180

1369

48 candles

335
330
665

37660
1470
39130
1956

Touched the glass

2.7723
9.3568
2.1291
2.1291
1.64 64
7.6324
3.5370

3440.

Lamp No. 1372

Wavy, tight and dark
16 candles

292
300
592

37660
5970
46630
23315

HW

2.7959
8.0246
1.3345
2.1550

9.3591

143 Volts

No 1372 22 candles

9-10 P.M. Put on Pump line

Deflection on pump line

310 R
315 L
625

Went in about two minutes with arc

JAM

2.7185
9.3591
2.0876
2.0776
1.6464
7.7772
3.5788   3790

This lamp placed so as give 48 candles. Melted off the German silver wire 4 ft. in with it. Clamps black and wire black. Put at sixteen candles blue at clamps. D = 285 after short time carbon gave out at clamps cleaning them and depositing carbon on the tip of the clamp removed from the break.

No. 1371

16 candles

259
264
523

25080
8100
33180
165.9

TAE

597 : 630 :: 151.9

2.1815
2.7993
7.2240
22048

160.0
151.9
8.1

2.7760
9.3591
2.1351
2.1351
1.6464
7.8185
3.7351

5430

No. 1371

48 [illegible]
see page 228

294
303
597

25080
5300
34350
151.9

2.7160
9.3591
2.0751
2.0751
1.6464
7.7792
13.5758 3760 ft.

No 1373

5" Bamboo

Very perfect carbon a slight bad spot near clamps
Straight
16 candles

TAE

255
265
520

31,370
1900
33270
166.35

2.7709
9.3591
2.1300
2.1300
1.6464
7.8242
37306 5380

590 : 630 :: 149.9 :

2.1758
2.7993
7.2291
2.2042

160.0
149.9
10.1 5+

Over p. 236

No., 1373
6" Bamboo

48 candles
by mistake very high

300
290
590

25080
4900
29980
149.9

6 hours
360 minutes

2.6990
9.3591

2.0581
2.0581
1.6464
7.7997

3.5623 3650 ft the.

From p. 234
Blue all through lamp good lamp when I put on pump line

Lamp No. 1373 [illegible]
6" Bamboo

16 candles again has been very high since last brought up

255
245

500

TAE

25080
6650

31730
158.6 Ohms

2.7076
9.3591
2.0667
2.0667
1.6464
7.7850
3.5648 3670

Lamp No 1374
6" Bamboo

Aug 5

Good straight carbon
16 candles

258
252
510

25080
7750
32830
16415

TAE

583 : 630 :: 156.1 :

2.1934
2.7993
7.2343
2.2270

168.8
156.1
12.7 6" 5"

2.7657
9.3591
2.1248
2.1248
1.6464
7.8067
3.7027 5040.

No 1374
6" Bamboo

46 candles

287
296
583

25080
6150
31230
156.1

Put on Pump line
8 minutes
Very bad spot in lamp

TAE

Lamp No 1376
6" Bamboo

Good straight carbon
16 candles over page 245

TAE

2.7839
9.3591
2.1430

2.1430
1.6464
7.6229
3.5553

3600 ft. lbs

Lamps 1376

6" Bamboo

~~48~~ 16 candles see p. 143

310
298
608

37660 TAE
[illegible]
[illegible]
2378[illegible] [illegible]

Burning four hours at —

$$\begin{array}{r} 2,8035 \\ 9.3591 \\ \hline 2.1626 \\ \cancel{2,1626} \end{array}$$

145,5

Pump line; Aug. 6, 1880.

Say 630

$$\begin{array}{r} 318. \\ 318 \\ \hline 636 \end{array}$$

$$\begin{array}{r} 45 \\ 49.5 \\ \hline 94.5 \end{array}$$

Lamp 1376 across the wires

27 candles TAE

313
317 Oscillates slowly up and down

with 3 machine current

$$\begin{array}{r} 318 \\ 309 \\ \hline 627 \end{array}$$

$$\begin{array}{r} 37660 \\ 7300 \\ \hline 44960 \end{array}$$

Lamp No. 1375
6" Bamboo

Bad lamp very high resistance blue at clamps

Hung direct across the line.

TAE

Lamps No. 1378
6" Bamboo

Went in glass on bringing up.

TAE

Pump line

Aug. 6, 1880

3 P.M. 20 cells

49
45.5
94.5 = 0

300
296

Changed

311
308
309

313 TAE.

Lamp No. 1379 Aug 6

6" Bamboo Taken from gas

Carbon wavy and uneven
48 candles

TAE

$$\frac{E^2}{R} \cdot 44.3 = \text{ft. lbs}$$

$$E^2 = \frac{\text{ft. lbs} \times R}{44.3}$$

3.6154
2.1761
8.3536

$\boxed{4.1451}$

2.0725

118 Volts

Aug 11 Wednesday eve

Mr. Edison wishes to start 200 lamps next Friday

Conductors.

The line leading along the turnpike to be wound with three layers of cloth tarred, then wound with marlin. TAE

See that plenty of cloth and marlin are ordered and that men enough are put on the job.

seven days labor

cloth, ok
marlin
tar
labor
rubber tape
lines cut off

Machines

3 # machines

Present lamp requires 115 Volts machine must run 1100 revs. The exciter must run from main shaft.

3 machines probably enough since the lamps are so much higher resistance TAE

must run 1100 revs,

The three machine in position now will do the business if changed to multiple arc which can be done in a minute.

Rig meters for
2 for 20 lights Edison Jordan
1 for 30 lights Laboratory

Lamps
Glass must have .. ok
Blowers
Pumps arrangement for bringing up lamps while on.
Pick out lamps . slacs the lamp post . and number lamps accordingly .
5 classes according to distance

Meter

The average E.M.F. is ... Volts

$\frac{115}{165}$ Webers

1 mg. per hour

1/10 mg. per hour

Houses

In Mrs Jordans relay the the wire out of sight.

~~Seguidors~~
Henricks
Hammer
Force

Haddle

TAE

Davis' Hotel Mrs.
Cornish's Kuesie Edisons

Wrap wire used in rubber. ~~tape~~ twice tape solder joints. use lead safety clutches.

67.75 1.8309
12.25 1.0881
7.28

58 candles

20 cells 46
40
86

TAE

48 candles

~~290~~ 290 ~~300~~
290 ~~270~~

31370
2500
33870
16935 Ohms

2.7731
8.06555
1.33345
2.1731

149 Volts

Pump line

300 - 310

305
288
593

300
280

304
285 — TAE

Lamp No 1399 C

48 candles

283
286

31370
6500
37870
189.35

TAE

Lamp No. 1416. High vacuum
6" Bamboo 0".012 X 0".012 first lamps
from new mould to carbonizing
so as to place in the clamps sideways

Straight carbon

Slightly wavy and irregular

16 candles

TAE

213
208

31370
2900

$\boxed{34270}$
17135 Ohms

Lamp No 1416

---

48 candles

247
238

TAE

31370
800

Lamps No. 1419

bad spot

48 candles

4-40

20 cells

40 both ways

267 on lamp

270

31370

TAE

Lasted about 10 minutes

Lamp No. 1420

6" Bamboo

48 candles

11-20 253
251

40.5
41. 20 cells

25.080
5700

11-30 Stopped

Lamp No. 1421

6" Bamboo

48 candles

223
224

TAE

25080
2900
27980

7.5

$\boxed{1oz \quad 1/2}$

3
2

.7559

8.2441
2.7782
1.3345
2.3568

227 Volts

32 oz 1 ~~Gallon~~
4
128 oz 1 Gall
.43
.85 hours

42.5
3
127.5

230
235
465

27
30
57

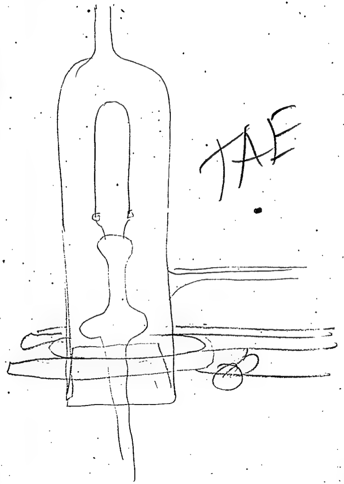
2.6675
8.2441
1.3345
2.2461

176 Volts

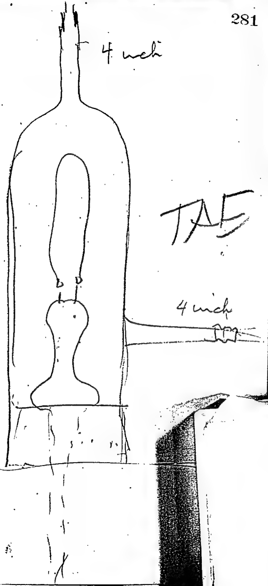
26
31
57

.4 mills for ten
.5 mills can hours

200
.4
80



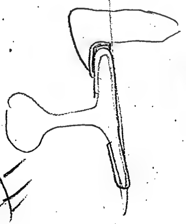
TAE



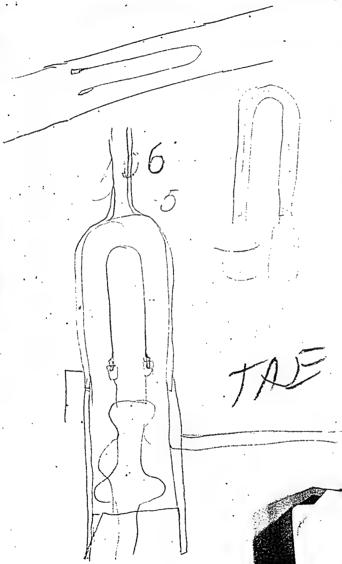
TAE

150	2.1761
	2.1761
	1.6464
4.8	9.3188
	5.3174
207,000	4.5185
	.7989

6.2 H.P



THE



THE

15 180
30
4500

70
4
280
10
1800

210
210
2100
210
420
44100
44
176400
176400
4/1940400

105
105
525
105
105
12075
44
48300
48300
531300
3
1593900

THE

1.940
4.58

6.2878
0.6812
5.6066
4.

404000

28. 15
60

40
4
160
10
1600

120/9.600(
4
72

40
1200

120
30
4
120
10

1/4 1/4

28.hp.

28.
3
84.

75

2600000
78
20800000
18200000
202800000

1200

120.
12
240.
120.
1440

4/1940400
485100

10.00
3
3000

101

48/485100
121275

48/485100(.101
48
51
48
200

48/4851000(1
48
5

THE

Menlo Park Notebook #113 [N-80-06-14]

This notebook covers the period June-August 1880. The name of George H. Hill appears on the cover. Hill's name and Edison's initials also appear on page one. There is no other indication of authorship. The book contains a record of tests on experimental lamps, numbers 1175 to 1505. The cover is labeled "Lamps on pump," "July 25, 1880," and "George H Hill." The book contains 284 numbered pages.

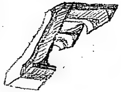
The following pages contain skeleton tables that were never filled in (not filmed): 8-25, 28-39, 48-49, 52-53, 154-177.

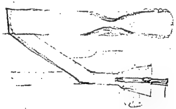
Blank pages not filmed: 178-281.

Book of Lamps

from 1175

No of Lamp	Remarks
1175	there was a good many Lamps made that no Record was kept of [illegible]
1177	



Cr of Lamp	Remarks
1175	there was a good many Lamps made that mo [illegible] Kim [illegible] Hier
1176	
1177	

start-950

1354 m Broke at 954

1356 L Broke 10.20

1357 R Broke 1030

1358 m start 957 to 11,37

1339 Started at [illegible]

1331 Aug 4, P.m.

[illegible] Broke

[illegible] minutes

1373 [illegible] 11.35

[illegible] Started 11.45

[illegible] Start at 12.[illegible]

No of Lamps	Remarks
1178	
1179	
1180	

No Samp	Remarks
1181	
1182	
1183	

Start 130 stop 145
[illegible] shots in carbon

No Lamps	Remarks
1184	
1185	
1186	

No Lamp	Remarks
1214	
1215	
July 5 84 1216	~~[illegible]~~ Large Lamp [illegible] grass [illegible] Spots in carbon [illegible] Carbon split in one Lamp after burning for 25 minutes it gave a Bright Light Volume 105 B

No Lamp	Remarks
July 26 1236	Bass fibes- Broke the carbon as soon as the current was put on did not give any light
1237	
July 26 1238	Bass fibes- there was Bad spots in the carbon very Bright spot at the clamp did not give a good light V 105-
July 24 1239	Bass fiber Extra no spots it gave a good light Vacuum 118

No Lamp	Remarks
1240	
July 23 1241	Bass Fibes - Bad spots in carbon and did not give a good Light. Vacuum 110
1242	
July 27 1243	Large Bass fiber - White wire through the Bulb and small piece of carbon on the end of wire no spots gave a good Light when sealed off V/08

No Lamp	Remarks
1244	
July 27 1245	Bars + tubes - Broke as soon as Current was let on
1246	
1247	

No Tamp	Remarks
1248	
~~[illegible]~~ 1249	~~[illegible]~~
1250	
1251	

No Lamp	Remarks
1256	
July 26 1257	Bass Fiber - no spots it gave a good light Vacuum 110
July 27 1258	Bass Fiber - Repaired Had spots in the carbon but it gave a good light - Vacuum When sealed off 107
1259	

No Lamp	Remarks
1264	
1265	
1266	
June 15 1267	Busted soon as put current on did not get no Light the carbon went into fine Powder-

No Lamp	Remarks
June 15 1268	no spots 100 m m slightly Blue With high Current
June 14 1880 1269	Bass fiber- dipped in solution of amonia no spots same Color- as all the ammonia
June 15 1270	Bass fiber- dipped in amonia same as 1269 no spots high Vacuum same color- as all amonia
June 15 1271	high Vacum no spots 100 m m

No Lamp	Remarks
June 16 1880 1272	Bass fiber- carbonized in Tee P.I- Recarbonized Platinum does not show very good on them gives it Platinum spark
June 16. 1880 1273	Bamboo fiber- no spots high Res Vacuum 100 m m Both Ends split inside 
June 16. 1880 1274	Good carbon no spots slightly Blue 95 m m
June 16 1880 1275	Good carbon no spots slightly Blue

No Lamp	Remarks
June 16 1880 1276	Bamboo with notch in one side very bad spots in it but not at the notch
July 17 1880 1277	Bamboo with notch cut in one side High vacuum 78 mm very good notch was very bright spot
1278	
July 17 1880 1279	Gave a good light no spots from 10.15 to 11.50 am high vacuum sealed off.

No Lamp	Remarks
July 17 1880 1280	Paper-carbon Bad spots and Very crooked carbon sealed off with high vacuum time 1.10. 255-8m
1281	
July 17 1282	Bamboo Fiber- no spots Very high slightly Blue When full Current was on
July 19 1283	Bamboo Fiber- Broke the Carbon as soon as Current was put on close to the clamp did not give any Light

No Lamp	Remarks
1284	
1285	Bamboo Fiber- no spots it gave a good light high Vacuum When sealed off. V 107 July 19
1286	Bamboo fiber- it gave a Good light it had no Bad spots in it- V 102 July 19, 1880.
1287	Bamboo fiber- no spots it gave a good light- Vacuum 107 July 19. 80

No Lamp	Remarks
1288	Spot Light high Vacum Bass fiber dipped in syrup Vacum 100 July 19, 90
July 19 1289	Same as 1288 gave a good light no spots Vacum when sealed off 103
July 20 1290	Bamboo fiber it was very Bright on one side of the Carbon and had spots in Vacum when sealed off 100
July 20 1291	Bass fiber with Plat on ends of Carbon no spots it gave a good light Vacum 112

No Lamp	Remarks
July 20 1292	Bass Fibes- several Bad spots in Carbon Bright spot in the centre of the Carbon and it did not give a very good light- Vacum 107
July 20 1293	
July 20 1294	Bamboo Fibes- no spots in carbon it was very even and gave a good light after it burnt for about half an hour found out that the Carbon was split in the clamp-
July 21 1295	Bamboo Fibes- there was some Bad spots in carbon as marked here Vacum 105 

No Lamp	Remarks
July 21 1880 1296	Bamboo Fiber- no spots it gave a good Light Vacum When sealed off 105.
1297	
July 21 1880 1298	Bamboo Fiber- there Was Several Bad spots in the Carbon Vacum When sealed off 105-
July 1880 1299	Bamboo Fiber- Very Even no spots gave a good Light But Was slightly blue Vacum 104

No Lamp	Remarks
July 21 1880 1300	Bamboo Fiber- one side of the Carbon Was dark and the other side Light Red Vacuum When sealed off 105
July 22 1301	Bamboo 12X12 Regular very Even no spots in the Carbon after it Burnt for about one hour - found out the carbon was split in in the clamp Vacuum 112
July 22 1302	Bamboo 12X12 Regular Sealed off there Was a Crack in the inside glass Could not get a Vacuum sealed off the pump
July 22 1303	Bamboo Regular Very Small spots in the Bottom of Carbon and gave a Bright Light on Bottom of Carbon V 112

No Lamp	Remarks
July 22 1304	Bamboo Fiber- several Bad spots in the carbon but it gave a Bright Light- Slightly Blue Vocuum 114
1305	
1306	
July 23 1307	Bamboo fiber 12X12 no spots after it Burnt for about 25 minuts found the Carbon was split in the clamp it gave a Bright- Vocuum 114

No Lamp	Remarks
July 23 1308	Bamboo fiber- 12X12 no spots it gave a good Light- Slightley Blue Vacums 112
July 28 1309	Bamboo fiber- no spots Gave a good Light- But Was slightley Blue Vacum 110.
July 22 1310	Japanese Bamboo Fiber- Bad spot in carbon as marked here there was a split in Carbon in the Clamp it did not show the split untill it Burnt for about 25 minuts Vacum 112
July 27 1311	Real Bamboo Fiber- very Even no Bad spots in Carbon after. it Burnt for about one hour. found out that the Carbon was split in the Clamp V 112

No Lamp	Remarks
July 21 1312	Real Bamboo Fiber one side of the Carbon Was a Little darker than the other it Burnt for about one hour found out that The carbon Was split in Clamp
July 22 1313	Japanese Bamboo fiber Broke as soon as Current Was Put on did not give any Light
July 22 1314	Japanese Bamboo Fiber Broke the Carbon as soon the Current Was put on did not give any Light high Vacum
1315	

No Lamp	Remarks
July 23 1316	amaranth Wood The Carbon Was full of Bad spots and showed the Blue very Plain Vacuum 104
July 23 1317	ordinary Bamboo no spots gave a good Light was slightley Blue Vacuum 112
July 24 1318	amaranth 12X12. Bad spots in the carbon showed the Blue very Plain at the clamps sealed off With high Vacuum
July 24 1319	White Holly Bad spots in the Carbon and gave a Poor Light Vacuum 103

No Lamp	Remarks
July 24 1320	White Holly Bad spots in Carbon it showed Blue very Plain from the Clamps and Carbon
July 24 1321	TULIP. WOOD 12X12 Broke on the Pump By the mercury Running in the Lamp By G.H.
July 24 1322	Bamboo Fibers. no spots it gave a good Light it Was Slightly Blue Vacuum 112
July 24 1323	Bass fibers are formed in the Clamp But it gave a Bright Light

No Lamp	Remarks
July 26 1324	Bass Car-bonized in Kerosene for instant- only no spots it gave a good light- showed Blue on the clamps Vacuum 105-
July 26 1325	manilla fiber- Treated in Kerosene Bad spots in the carbon gave a Bright Light Vacuum 107.
1326	treated in Kerosene soon as current Was put on it Broke the Carbon at the Clamps
July 27 1327	made in oven mould Regular- no spots very even gave a good light after. it Burned for about 30 minutes found out the Carbon Was split on clamps V110

1331 Started [illegible] at
[illegible] 2 [illegible] Pm

No Lamp	Remarks
July 27 1328	made in new mould 12X12 Same as 1327 no spots it gave a good light V112
July 28	1328 Put on second time no spots it gave a good light Vocuum 112
July 27 1329	no spots it gave a good light very high current Vocuum when sealed off 110
1330	
July 1331	Bamboo Bad spots in carbon it gave a Bright Light with high Current Vocuum 110

No Lamp.	Remarks
July [illegible] 1332	Bamboo Bad spots in the Carbon Clost to the clamp <u>Vocuum 110</u>
July [illegible] 1333	Bamboo Bad spots in the Carbon and bright spot at the Clamp it gave a very Bright Light. Vocuum when sealed [illegible].108
1334	
July [illegible] 1335	Bamboo Regular 12X12 no spots it gave a good Light after it Burnt for a half an hour Found out the Carbon was split in the Clamp Vocuum 110

1339 [illegible] it Burn
5 minutes Past 2 Aug 4 P.m

No Lamp	Remarks	
July 30 1336	Bamboo Reg 12 X 12 With [illegible] of Carbon no spots [illegible] Light – Vacuum [illegible] 110	
July 1337	Large 6 in fibre [illegible] it gave a good Light after it Burnt for about 25 minutes found out the Carbon Was Split in clamp V 100	
July 1338	Large 6 in fibre no spots As soon as the Current [illegible] was put on saw the carbon was split in the clamp it gave a Bright Light Vacuum 110	
Aug 2 1339	Bass fibre – Bad [illegible] in the [illegible] But it gave a good Light Vacuum 95	

No Lamp	Remarks	
Aug 2 1340	Bass fiber - Same as 1339 Bad spots in carbon it gave a good Light was slightly Blue Vacuum 99-	
July 31 1341	Bamboo 12 X 12 Large fiber Bad spots in the carbon. Vacuum 95	
July 31 1342	Paper-Carbon no spots gave a good Light Vacuum 107	
July 30 1343	Large fiber no spots gave a good Light Vacuum 100	

No. Lamp	Remarks
Aug 2 1344	Large fiber- no spots it gave a good Light Slightly Blue Vacuum 105
Aug 2 1345	Large fiber- no Spots gave a good Light- Slightly Blue Vacuum when sealed off 105
Aug 2 1346	Large fiber- no spots gave a good Light was Slightly Blue Vacuum when sealed off 105
Aug 3 1347	Large fiber Bad spots in the carbon but it gave a Bright Light and was Slightly Blue Vacuum 107

No Lamp	Remark
Aug 2 1348	Large Fiber no spots it gave a good Light is slighty Blue Vocuum 110
Aug 3 1349	Large fiber no spots it gave a good Light slighty Blue Vocuum 105
Aug 3 1350	Large Fiber no spots it gave a good Light after it burnt for about one hour found out the Carbon has split in the Clamp slighty Blue V105
Aug 3 1351	Large fiber no spots it gave a good Light Vocuum 105

No Lamp	Remarks
Aug 3 1352	Large Fiber - no spots it gave a bright Light was slighty Blue Vocum 107
Aug 3 1353	Large fiber - no spots gave a good Light was slighty Blue Vocum 105
aug 3 1354	Large fiber - no spots it gave a good Light was slighty Blue [illegible] 110
Aug 4 1355	Large fiber - no spots after it Burnt for a few minuts found out the Carbon was split in the [illegible] it gave a good Light Vocum 1[illegible]

Started 950 Broke 10.20

13 Started the Burn at 950
Broke 10.80

~~1357 Start ... 944~~
~~Broke at 11.30~~ Started the
Burn 957, Broke 11.87

No Lamp	Remarks
Aug 4 1356	Large fiber ... [illegible] as Ben [illegible] And Vacuum when [illegible]
Aug 4 1357	Large fiber ... it [illegible] Light Carbon [illegible] Vacuum 100
Aug 4 1358	Large fil[illegible] [illegible] V[illegible]
Aug 4 1359	Large fiber Bad spots But it gave a good Light Vacuum 98

No Lamps	Remarks
Aug 5 1360	Large Bamboo fiber no spots [illegible] [illegible] Vacuum 95
Aug [illegible] 1361	[illegible] Bad spots on carbon gave a Bright Light – Sealed off with high
Aug 7 1362	[illegible] fiber
1363	

1366 Started to Burn 750
Broke at [illegible]

1367 [illegible] at 12.5 Aug 6
Burn 750. [illegible]

No Lamp	Remarks
1364	
1365	
Aug 4 1366	Large Bamboo [illegible] Bad spot in Carbon Carbon was split in the clamps gave a good [illegible] Vacuum 100
Aug [illegible] 1367	Large Ba[illegible] no spots it gave a good light Vacuum 100

No Lamp	Remark
Aug 4/2 1368	Large Bamboo fibre- Bad spots in Carbon split in Clamps But gave a good light Vacuum 98
Aug 5 1369	Large Bamboo fibre- Bad spots in the Carbon Gave a good light Vacuum 104
Aug 5-2 1370	Large Bamboo fibre- full of bad spots and Gave a poor light Taken off without exhausting
5 1371	Large Bamboo fibre- no spots Gave a good light Vacuum 100

1373 [illegible] the Burner
[illegible] Broke 5.15

1374 [illegible] the Burner
11.13 [illegible] Burnt 5 minuts

1375 [illegible] 11.45 am

No Lamp	Remarks
Aug 5 1372	Large fiber no spots it gave a good light. Vocuum 100
Aug [illegible] 1373	Large fiber no spots it gave a good light. Vocuum 90
Aug 5 1374	Large fiber no spots gave a good light Vocuum 100
Aug 5 1375	Large Bamboo fiber Bad spots in the Carbon Split in the clamp

Ohm [illegible]
Broke 935

No Lamp.	Remarks
Aug 5 1376	[illegible] no spots Carbon [illegible] Clear [illegible] Light [illegible] Vacuum [illegible]
Aug 5 1377	Large fiber Ex permanent X Bad spots on Carbon [illegible] gave a bright [illegible] slightly Blue
Aug 5 1378	Large fiber Ex permanent no spots It gave a good [illegible] service [illegible] With high Vacuum
Aug 5 1379	Large fiber no [illegible] gave a good [illegible] high Vacuum [illegible] Pump

No Lamp	Remarks
Aug 6 1380	Large fiber no spots gave a good light broke off with rack. Vacuum New pump
Aug 6 1381	Large fiber Bad spots after burnt for a few minutes burn in small spot on side of carbon did not show when first heated. Taken off without lighting
Aug 6 1382	Large fiber no spots it gave a good light and was standing fine. high Vacuum New Pump
Aug 6 1383	Large fiber no spots it gave a good light was left in the lamp high Vacuum

No Lamp	Remarks
Aug 1384	Large filter no shorts [illegible] in the [illegible]
[illegible] 1385	Large filter no sparks gave a good light it was [illegible] high Vacuum [illegible]
[illegible] 1386	Large filter no sparks gave a good light high Vacuum [illegible]
Aug 6 1387	[illegible] filter no [illegible] Broke in the pump with a high Vacuum

Aug 6

1888 no spots Carbon
was split in clamp
sealed off high Vacuum

1887 was missed when
[illegible]

1392 Large fiber - Run on
pump second time

No Lamp	Remarks
Aug 6 1389	no spots the Carbon was split in the clamp sealed off high Vacuum
Aug 6 1390	[illegible] no spots Broke by letting the mercury Run out of the pump
Aug 6 1391	Large fiber Bad spots did not give a good Light
Aug 6 1392	Large fiber no spots split in clamp could not get a high Vacuum glass [illegible] off the inside [illegible] at wire

No. Lamp	Remarks
Aug 7 1393	Large Fil[illegible]
Aug 7 1394	Large filam. Bad spots [illegible] [illegible] [illegible] [illegible]
Aug 7 1395	Large filam. no spots gave a [illegible]
Aug 1396	Large filam. [illegible] Cracked in one [illegible] in clamp gave a [illegible] [illegible]

1400 A Bad spots in Carbons after it Burnt for about half an hour the Carbon split apart in the Clamp and broke rolled off

1399 C no spots gave a good light - split in Clamp
high Vacuum

1399 B no spots gave a good light
high Vacuum

AUG. 11. 1880
1400 $\boxed{\text{No 5}}$ C Large fiber-

~~1400 A Bad spots in Carbons~~
~~cracked in clamp Broke on pump~~

No Lamp	Remarks
1397	Large fiber-
Aug 7 1398	Large fiber- no spots gave a good light high [illegible]
Aug 11 1399	A Large fiber- no spots gave a good light did not get a high Vacuum By order of TAE.
Aug 11 1400	B. Large fiber- no spots gave a good light did not get a high Vacuum By order TAE

1402 Large fibers - B
Bad connections in the lamp could not get any light

No Lamp	Remarks
Aug 12 1401	Large fibers - Bad spots But it gave a good light did not get a high Vacuum By order - TAE
Aug 12 1402 ☆	Large fibers - ~~Bad spots~~ did not give a good light - Bent out of shape LOW. VACUUM By order - TAE
1403	
1404	

No Lamp	Remarks
1405	
Aug 12 1406	Large fiber - no spots gave a good light it bent very little to one side high Vacuum
Aug 12 1407	Large fiber - Broke the Carbon by taking off the pump did not Exhaust
Aug 12 1408	Large fiber - Bad spots Bent as soon as the current was put on gave a Bright light sealed off by order Mr Upton

No Lamp	Remarks
Aug 12 1409	Large fiber Bad spots the carbon bent out of shape as soon as current was put on gave a bright light sealed off by order from Mr Upton
Aug 12 1410	Large fiber Bad spots did not bend as much as No 1408 and 1409 gave a good light
Aug 12 1411	Large fiber Bad spots did not bend as much as No 1408 and 1409 gave a good light was split in the clamp
1412	
X	

No Lamp	Remarks
Aug 12 1413	Large fiber - Broke the Carbon as soon as the current was put on did not get any Light
Aug 16 1414	Large fiber - Bad spots the Carbon was corrigated gave a good light Bent out of shape Broke when full current was put on
1415	
Aug 12 1416	Large fiber - Bad spots gave a bright light did not bend the Carbon did not get a high Vacuum

No Lamp	Remark
Aug 12 1417	Large fiber- did not Exhaust- sealed off by order- from Mr Upton
Aug 13 1418	Large fiber no spots the carbon was carrigated and gave a good Light did not Bend any high Vacuum
Aug 13 1419	Large fiber- same as 1418 Bad spots in the Carbon gave a good Light did not Bend the carbon when full Current was on. Very strait high Vacuum when sealed off.
Aug 13 1420	Large fiber- Bad spots in Carbon split- in the Clamp. Gave a good Light Bent very little sealed off with high Vacuum

No Lamp	Remarks
Aug 13 1421	Large fiber - [illegible] spots Gave a good light - [illegible] Little sealed off with high Vacuum
Aug 13 1422	Large fiber - Bad spots - Gave a bright light - Was sealed off did not get a high Vacuum the Engine stopped for all night
Aug 13 1423	Large fiber - Bad spots - Gave a bright light - did not get a high Vacuum the Engine stopped for the night - did not have any steam
Aug 14 1424	Large fiber - no spots Gave a good light - did not [illegible] high Vacuum

No Lamp	Remarks
Aug 14 1425	Large fiber - Broke as soon as the Current was put on did not give any Light
Aug 14 1426	Large fiber - Bad spots in the carbon and Bent as soon as the current was put on did not Exhaust
Aug 15 1427	Large fiber - Bad spots the carbon was Corrugated gave a good light the carbon Bent very little slightly Blue High Vacuum
Aug 15 1428	Large fiber - Bad spots the Carbon was Corrugated gave a [illegible] - Light was Bent a little to one side high Vacuum

[illegible] Upton

No Lamp	Remarks
Aug 14 1429	Large fiber - no spots split - in the clamp did not bend Broke on the pump by the Boy striking the Lamp N.G.
Aug 14 1430	Large fiber - Bad spots in the carbon and did not Exhaust the carbon was no good sealed off N.G
Aug 16 1431	Large fiber - no spots gave a good Light was split in the clamps slightly Blue high vacuum did not bend
Aug 16 1432	Large fiber Bad spots did not give a good Light - it bent the carbon when current was put on - did not get a high vacuum

1433 Large fibers-
Bad spots split in clamp
gave a Bright Light- but
it bent over to one side
high Vacuum

No Lamp	Remarks
Aug 14 1434	Large fibers- Bad spots gave a Bright Light Broke on the pump and made a Loud Report same as a Pistol
Aug 16 1435	Large fiber- no spots gave a good Light and did not bend the Carbon When current was on.
Aug 18 1436	Large fibers- no spots gave a good Light and did not Bend High Vacuum
Aug 18 1437	Large fibers- Bad spots gave a good Light- Bent very Little high Vacuum

No Lamp	Remarks
Aug 19 1438	Large fiber - Bad spots in the Carbon close to the clamp Bent very little but it gave a good light sealed off with Vacuum at 45
Aug 19 1439	Large fiber - no spots gave a good light did not Bend high Vacuum
Aug 15 1440	~~Small~~ fiber - Bad spots gave a good light could not get a high Vacuum Lamp was on pump 3½ hours
Aug 18 1441	Large fiber Bad spots in Carbon close to the clamp split in clamp gave a Bright light could not get a high Vacuum Sealed off

No of Lamp	Remarks
Aug 18 1442	Large fiber- Bad spots gave a good light- did not Bend any sealed off With high Vacuum
Aug 18 1443	Large fiber- Bad spots gave a good Light- Was slightly Blue did not Bend any high Vacuum
Aug 19 1444	Large fiber- no spots gave a good Light Bent very Little high Vacuum
Aug 18 1445	Large fiber Bad Spots gave a good Light- did not Bend high Vacuum

No of Lamp	Remarks
Aug 18 1446	Large fiber- Bad spots Gave a good Light- did not Bend the Carbon any Perfectly strait Very high Vacuum
Aug ~~20~~ 2 1447	[illegible] in glass then [illegible] Large fiber- Bad spots very Bad spot at the Clamp and Bent out of Shape did not get a high Vacuum Lamp N G
Aug ~~20~~ 20 1448	~~Large fibers [illegible]~~ Large fiber- no spots Gave a good Light- did not Bend any Perfectly strait high Vacuum
Aug 18 1449	Large fiber- Bad spots Gave a good Light- Bent very Bad did not get a high Vacuum

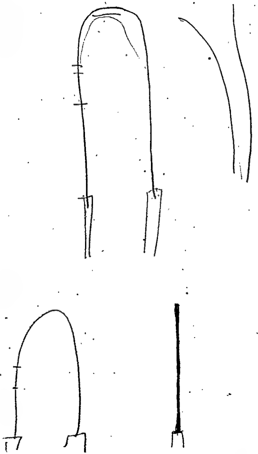
No of Lamp	Remarks
Aug 18 1450	Large fiber - Bad spots Gave a good Light - did not Bend any sealed off with high Vocuum
Aug 20 1451	Large fiber - Bad spots gave a good Light split in the Clamp. Bent very Little high Vocuum
Aug 19 1452	Large fiber - Bad spots gave a good Light. Bent very Little sealed off with high Vocuum
Aug 18 1453	Large fiber - 8/1000 X 16/1000 no spots Perfectly strait sealed off high Vocuum By order - TAE

No. of Lamp	Remarks
Aug 20 1454	Large fibers - 9/1000 By 15/1000 no spots gave a good Light the carbon Bent some sealed off good vacuum Taken By McKensie
Aug 19 1455	Large fibers - 9/1000 By 15/1000 Bad spots gave a good light Broke on the Trunk the inside bulb cracked with a good vacuum
Aug 20 1456	Large fibers - 9/1000 By 15/1000 no spots gave a good light the carbon Bent one clamp got Black had a high vacuum
Aug 19 1457	Large fibers - 8/1000 By 16/1000 no spots gave a good Light did not Bend high vacuum

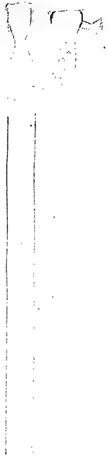
No Lamp	Remarks
Aug 20 1458	Large fibes 9/1000 16 x 1000 Bad spots the carbon Was carrigated and Bent out of Shape could not get a high Vacuum on pump 3 hours split in Clamp
Aug 21 1459	Large fiber 9/1000 By 15/1000 no spots Carbon was [illegible] the Clamp gave a good light scan [illegible] With high Vacuum
Aug 21 1460	Large fiber 9/1000 By 15/1000 no spots gave a good light Kept [illegible] little high Vacuum
Aug 21 1461	Large fiber Button Carbon Tester Bad Spots did not Put in [illegible] very Bright spot in Bottom of carbon time 15 minuts

1463 Was on the Carbon tester before going on the pump and had Light spots

No Lamp	Remarks
Aug [illegible] 1462	[illegible] Was on the carbon tester and had bright spots in [illegible] it looked almost [illegible] [illegible] current [illegible] Bad [illegible] [illegible] The [illegible]
Aug 25 1463	Large fiber - nickel clamps very Light spots gave a good Light when full current was on there was a Blue spots about the clamps Bent very Little
Aug 25 1464	Large fiber nickel clamps Light spots in the carbon gave a good Light Sealed off with high Vacuum did not Bend
Aug 25 1465	Large fiber nickel clamps Carbon was on the carbon Tester before going in Lamp no spots gave a good Light was slightly Blue Bent very Little high Vacuum



65



Clean finish With
Benzine and Pass as
through

Geo H Hill
Sunday July 25-1880

AUG [illegible] 1880

A Note on the Sources

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END

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